2012 NAVY MANTECH

PROJECT BOOK

Navy ManTech…transitioning affordable manufacturing technology to the Fleet

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2012 Navy ManTech Project Book: This 2012 edition of the Navy ManTech Project Book provides brief write-ups for most of the Navy ManTech projects active in FY11. To highlight the Navy ManTech's Investment Strategy with its concentration on development of manufacturing technology for a few key platforms, the projects are organized by platform or, in some cases, by organization. Feel free to contact any of the Points of Contact listed in the project write-ups for additional information on any Navy ManTech project.

Navy ManTech Overview

The Navy Manufacturing Technology (ManTech) Program responds to the needs of the Navy for the production and repair of platforms, systems, and equipment. It aids in achieving reduced acquisition and total ownership costs by developing, maturing, and transitioning key manufacturing technologies and processes. Investments are focused on those that have the most benefit to the Warfighter.

For the past six years, the Navy ManTech Program has been focused on shipbuilding affordability improvements for key shipbuilding acquisition platforms and has recently added the Joint Strike Fighter (JSF) as a secondary affordability target. ManTech helps these Navy programs achieve their respective affordability goals by transitioning needed manufacturing technology which, when implemented, results in a cost reduction or cost avoidance (measured as $/hull or $/aircraft).

Navy ManTech works with defense contractors, the Naval Research Enterprise, Navy acquisition Program Offices, and academia to develop improved processes and equipment. The Program is structured to promote timely implementation to strengthen the defense industrial base. With their expertise in specific technology areas, the Navy ManTech Centers of Excellence (COEs) play a key role in the definition and execution of the Program.

Together with the Navy ManTech Program Office, representatives of the customers, industrial entities, and the COEs function as a team to define projects that address the needs of the Navy in time to make a difference. As an example, extensive interaction and cooperation between Navy ManTech, Navy ManTech COEs, General Dynamics Electric Boat, Huntington Ingalls Industries – Newport News, PEO (Subs), and the PMS 450 Program Office resulted in a focused ManTech initiative for the VIRGINIA Class submarine (VCS). To date, technology from 21 of the ManTech VCS portfolio of approximately 70 projects, have been implemented for a resulting real acquisition cost savings of approximately $19M per hull, verified by our industrial partners and PMS 450.

Management of the Navy ManTech Program is by the Office of Transition within the Office of Naval Research (ONR), with direct oversight from the Chief of Naval Research. With the transition of technologies to the Fleet and acquisition as top priorities, ONR's Office of Transition is composed of transition-centric programs including ManTech, Future Naval Capabilities (FNCs), the Small Business Innovation Research (SBIR)/Small Business Technology Transfer (STTR), and other transition initiatives.

The directors of the ManTech programs of the Army, Navy, Air Force, and Defense Logistics Agency (DLA) coordinate their programs through the auspices of the Joint Defense Manufacturing Technology Panel (JDMTP) with representation from the Office of the Secretary of Defense (OSD), the Department of Commerce's National Institute of Standards and Technology (NIST), the Department of Energy, and industry. The JDMTP is organized to identify and integrate requirements, conduct joint program planning, and develop joint strategies. Department of Defense (DOD) oversight is provided by the Office of Manufacturing and Industrial Base Policy (MIBP) which was established by the 2011 National Defense Authorization Act (NDAA) to ensure that the linkage between industrial policy and manufacturing is firmly established and effectively coordinated.

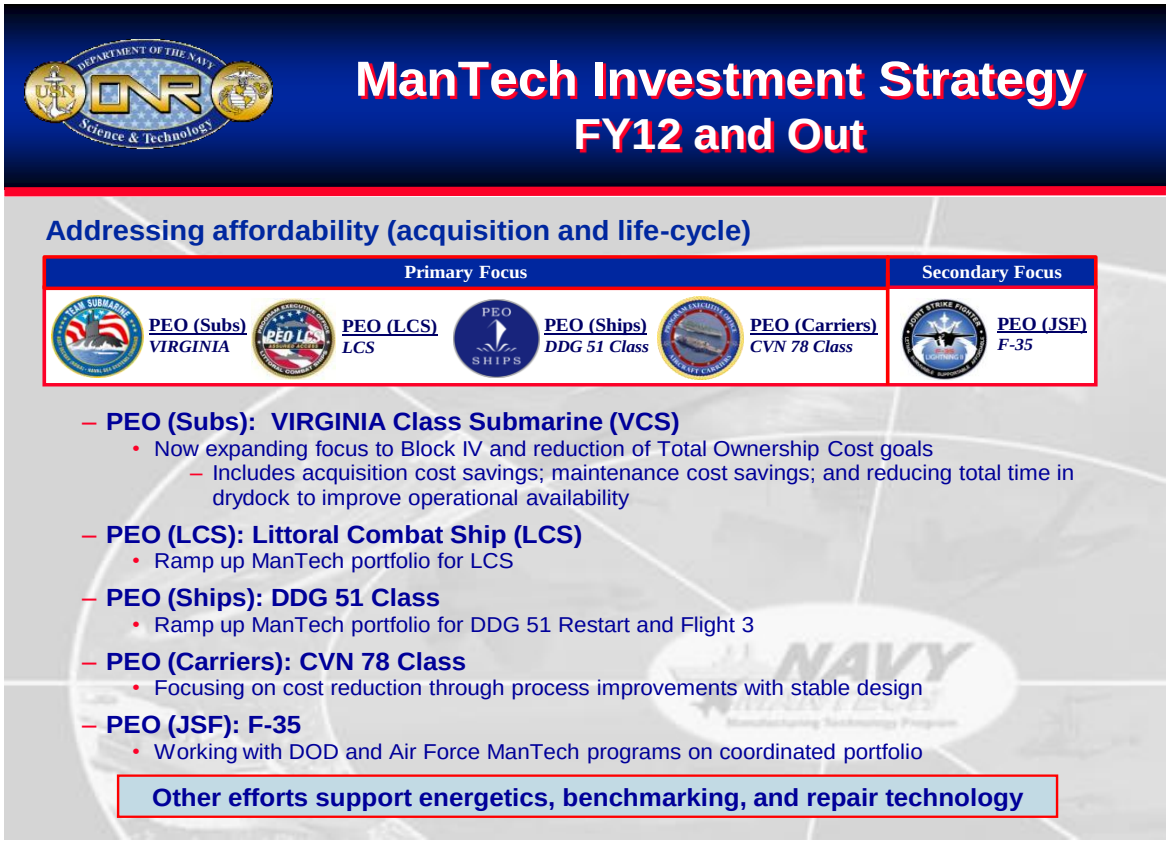
Navy ManTech Objectives

The overall objective of the Navy ManTech Program is to improve the affordability and readiness of Department of the Navy (DON) systems by engaging in manufacturing initiatives that address the entire weapon system life cycle and that enable the timely transition of technology to industry to support the Fleet. More specifically, DOD Directive 4200.15 states that ManTech investments shall:

1. Aid in the economical and timely acquisition and sustainment of weapon systems and components.
2. Ensure that advanced manufacturing processes, techniques, and equipment are available for reducing DOD material acquisition, maintenance, and repair costs.
3. Advance the maturity of manufacturing processes to bridge the gap from research and development advances to full-scale production.
4. Promote capital investment and industrial innovation in new plants and equipment by reducing the cost and risk of advancing and applying new and improved manufacturing technology.
5. Ensure that manufacturing technologies used to produce DOD material are consistent with safety and environmental considerations and energy conservation objectives.
6. Provide for the dissemination of Program results throughout the industrial base.
7. Sustain and enhance the skills and capabilities of the manufacturing workforce, and promote high levels of worker education and training.
8. Meet other national defense needs with investments directed toward areas of greatest need and potential benefit.

Navy ManTech Investment Strategy

The Navy ManTech Program Investment Strategy concentrates ManTech investments on reducing both the acquisition and life-cycle costs of key Navy acquisition programs. ManTech transitions manufacturing technology which, when implemented, results in a cost reduction or cost avoidance. Platforms for investment are determined by total acquisition funding; stage in acquisition cycle; platform cost reduction goals; cost reduction potential for manufacturing; and other factors primarily associated with the ability of ManTech to deliver the technology when needed. Since FY06, ManTech investments have been focused on affordability improvements for: CVN 78, Class carrier, DDG Family (first DDG 1000 and now DDG 51), the Littoral Combat Ship (LCS), and the VIRGINIA Class submarine (VCS). Recently added to the ManTech investment strategy as a secondary affordability target is the Joint Strike Fighter (JSF). For the JSF portfolio, efforts will be coordinated with the DOD and Air Force ManTech Programs.



Strategic planning for Navy ManTech is an ongoing effort. Navy ManTech annually analyzes acquisition scenarios and plans to determine major acquisition programs for potential investment. As the current platforms ManTech supports mature through their respective acquisition cycles, ManTech's investment targets will change.

Although different in focus, scope, and size, ManTech's affordability initiatives function similarly. For each, ManTech has established an integrated process team or IPT with representatives from Navy ManTech, the platform Program Office, and representative industry. The IPT meets regularly to coordinate and review the portfolio and ensure that projects are completed in time to meet the platform's window of opportunity for implementation.

Navy ManTech Investment Strategy

Individual Navy ManTech projects are developed in conjunction with industry and the acquisition Program Manager (PM). With their expertise in specific manufacturing areas, the Navy ManTech COEs play a key role in project definition. Planning for transition prior to the initiation of projects is critical for the implementation of technology on the factory floor and eventually into the Fleet.

To clarify communication between program participants, Navy ManTech has established definitions for “transition” and “implementation”. For Navy ManTech purposes:

- **Transition** denotes that point at which the ManTech project is completed and the technology meets customer (Program Office / industry) criteria / goals for implementation.
- **Implementation** denotes the actual use on the factory floor of ManTech results. (The resources for implementation are typically provided by entities other than ManTech including the Program Office and/or industry).

Agreements are reached on the degree of participation of the PEO/PM in support of the projects. The goal is for each PEO/PM to contribute resources to enable successful completion and implementation of the ManTech projects. Resources supplied may include financial support or cost share for the ManTech project itself or funding of Navy laboratory personnel to provide test, evaluation, certification, and/or other services. In addition, each PEO/PM is expected to provide personnel with technical expertise and/or management experience to assist the ManTech Program Office in project oversight. This support affords assurance that the weapon system PM is truly committed to the successful outcome of the ManTech project. In addition, this close working relationship between the parties provides ManTech with a longer-term view of implementation.

On a per-project basis, Technology Transition Plans (TTPs) document roles, responsibilities, and required resources needed to achieve transition and implementation. TTPs highlight the path from the technology development that ManTech performs to implementation on the factory floor. TTPs are signed by Navy ManTech, the relevant COE Director, a management representative of the industrial facility where implementation will occur, the Program Office, and, if appropriate, the Technical Warrant Holder. To assess progress, ManTech has instituted a quarterly tracking of TTPs and an annual assessment of transition and implementation.

Semi-annual affordability assessments identify projected cost reduction / avoidance per project, as well as an estimated total ownership cost savings per platform. These assessments, verified by industry and the relevant Program Offices, provide critical information to ensure that ManTech can continue to meet both platform and ManTech affordability goals and are essential to the Program’s success.

While the large majority of annual ManTech Program resources are invested in accordance with the shipbuilding affordability investment strategy, Navy ManTech does support smaller efforts in Benchmarking and Best Practices, Energetics, and Repair Technology (REPTECH).

Benchmarking and Best Practices: The Benchmarking and Best Practices Center of Excellence (B2PCOE) is a Navy and DOD resource for sharing best practice standards for mature manufacturing technologies, stable and producible designs, and mature production processes. The B2PCOE maintains strategic partnerships with academic organizations, industry, and government across all technology disciplines that impact Navy and DOD platforms and weapon systems. More information on the Navy ManTech's B2PCOE can be found on Page 8.

Energetics: Energetics ManTech projects develop and transition process technologies for the synthesis of new or improved energetic materials, improved manufacture of propellants and explosives, and improved handling and loading of energetic materials into systems and components. Concentration is on developing solutions to ensure the availability of safe, affordable, and quality energetics products in support of Program Executive Offices such as Integrated Warfare Systems (PEO IWS/IWS3C) and Conventional Strike Weapons (PEO (W)/PMA 201). More information on Navy ManTech's Energetics Manufacturing Technology Center (EMTC) can be found on Page 10.

REPTECH: While the major emphasis of the Navy ManTech Program is on support of new production, ManTech also addresses repair, overhaul, and sustainment functions that emphasize remanufacturing processes and advancing technology. The REPTECH Program focuses on fielded weapon systems and provides the process and equipment technology needed for repair and sustainment. Requirements for REPTECH projects are driven by Navy depots, shipyards, Marine Corps Logistics Bases, intermediate maintenance activities, and contractor facilities responsible for overhaul and maintenance of Fleet assets. In general, REPTECH projects are usually shorter in duration and are funded at lower levels than standard ManTech projects. The REPTECH Program is run by the Institute for Manufacturing and Sustainment Technologies (iMAST). More information can be found on Page 10.

Navy ManTech Execution

The COEs were established as focal points for the development and transition of new manufacturing processes and equipment in a cooperative environment with industry, academia, and the Naval Research Enterprise.

The COEs:

- Execute projects and manage project teams
- Serve as a corporate expertise in technological areas
- Collaborate with acquisition program offices/industry to identify and resolve manufacturing issues
- Develop and demonstrate manufacturing technology solutions for identified Navy requirements
- Provide consulting services to Naval industrial activities and industry
- Facilitate transfer of developed technologies

Descriptions of ManTech's nine COEs are presented below.

Benchmarking and Best Practices Center of Excellence (B2PCOE)

The Benchmarking and Best Practices Center of Excellence (B2PCOE) mission is to identify, validate, and disseminate best in-class practices, processes, methodologies, systems, and best practice technologies with the end objective of improving the level of competitiveness of the defense industrial base and the affordability and performance of defense platforms and weapon systems. The B2PCOE vision is to be a Navy and Department of Defense resource for sharing best practice standards for mature manufacturing technologies, stable and producible designs, and mature production processes.

Operated by the ACI Technologies Inc. in Philadelphia, PA, the B2PCOE identifies, validates, and disseminates best practice standards by formally integrating each ManTech Center of Excellence, small businesses, academia, and industry; and thus fostering high levels of horizontal communication and collaboration. The B2PCOE maintains strategic partnerships with academic organizations, industry, and government across all technology disciplines that impact Navy and DOD platforms and weapon systems.

B2PCOE Web site: www.dodb2pcoe.org

Center for Naval Shipbuilding Technology

The mission of the Center for Naval Shipbuilding Technology (CNST) is to identify, develop, and deploy in U.S. shipyards, advanced manufacturing technologies that will reduce the cost and time to build and repair Navy ships. The Center works closely with the Navy's acquisition community and the shipbuilding industry to identify manufacturing technology issues that negatively impact shipyard efficiency, with respect to both cost and cycle time. CNST solicits, selects, funds, and manages projects to address these critical and costly issues. The projects are focused on improving major ship construction and repair processes, such as optimizing production processes, predicting and reducing weld distortion, developing more efficient structural fabrication product lines, increasing the use of robotic welding methods, and eliminating inefficiencies in training, material usage, and supply chain procedures.

CNST has been operated and managed by Advanced Technologies International (ATI) in Charleston, SC since 2003. Looking forward, CNST will pursue technologies focused on improving the affordability of current Navy acquisition programs. New projects being considered include investigating the use of modernized production planning systems, further enhancing the use of computed radiography technologies, researching savings opportunities for high-cost components, streamlining material flow to and within storage and construction areas, investigating wireless management applications, and developing improved scheduling systems for new, aggressive build strategies.

CNST Web site: http://www.cnst.us

Composites Manufacturing Technology Center

The Composites Manufacturing Technology Center (CMTC), established in 2000, is located in Anderson, SC and is operated by Advanced Technologies International (ATI). The CMTC is consortium-based with a balanced membership providing expertise to address all Navy composites manufacturing technology needs. The Composites Consortium (TCC) membership includes prime contractors, composites industry suppliers, and universities. TCC has strong, in-depth knowledge and experience in composites manufacturing technology for all modern DOD weapon systems. As part of CMTC's organizational structure, all laboratories, facilities, and project labor resources are provided by project teams assembled from consortium members. This unique structure results in cost benefit to the Navy, with maximum funding going to project execution. CMTC's current portfolio includes composites manufacturing projects for manned and unmanned aircraft, surface ships, submarines, missiles, and land vehicles.

CMTC Web site: http://cmtc.scra.org

Electro-Optics Center

Since 1999, the Electro-Optics Center (EOC) has served as the Office of Naval Research's (ONR) Manufacturing Technology Center of Excellence for Electro-Optics. The EOC's goal is to reduce acquisition costs, operational costs and life-cycle costs while simultaneously improving mission capability of electro-optic military hardware and enabling transition of technology to industry, and, therefore, to the Warfighter. Since its inception, the EOC and its partner members of its Electro-Optics Alliance (EOA) have completed over 64 ManTech projects which have resulted in significant savings to the taxpayer. The purpose of the EOA is to advance DOD critical E-O Manufacturing Science and Technology and to promote U.S. preeminence in all areas of E-O. Alliance membership is available at no cost to all U.S. companies, government labs, and academic institutions involved in E-O technology. The EOA is committed to advancing the commercial viability of E-O technologies and promoting technology transfer to industry, as well as wide dissemination of new E-O related information.

The EOC, a proud part of The Pennsylvania State University, is a hybrid between the best components of a university and those of private industry. This relationship enables access to the university's researchers and scientists, its state-of-the-art facilities, and leading-edge research. EOC staff, comprised primarily of former industry and DOD personnel, brings experience in exceeding sponsor and corporate expectations. Through the application of this hybrid model, the EOC is able to provide its sponsors with solutions that combine leading edge research with on-time and on-budget deliveries.

EOC Web site: http://www.eoc.psu.edu

Electronics Manufacturing Productivity Facility

The Electronics Manufacturing Productivity Facility (EMPF) was established in 1984 to aid the electronics industry in improving electronics manufacturing processes required in the manufacture of military systems. Today, the EMPF operates as a national electronics manufacturing COE focused on the development, application, and transfer of new electronics manufacturing technology by partnering with industry, academia, and government centers and laboratories to maximize available research capabilities at the lowest possible cost. The EMPF serves as a corporate residence of expertise in electronics manufacturing. The EMPF's principal goals are to: improve responsiveness to the needs of DOD electronics systems; ensure that deliverables make a significant impact in the electronics manufacturing industry; facilitate the development and transition of technology to the factory floor; and expand the customer base to a national level.

The EMPF operates in a modern 36,000 square foot facility adjacent to the Philadelphia International Airport. The facility houses a demonstration factory containing the latest electronics manufacturing equipment, fully equipped classrooms for skill-based and professional level technical training, and an analytical laboratory for materials and environmental testing. The EMPF offers many electronics manufacturing services and capabilities to the Navy, DOD, and the electronics manufacturing industrial base.

The EMPF's resident technical staff consists of the nation's leading electrical engineers, mechanical engineers, materials scientists, chemists, physicists, instructors, and technicians. The EMPF staff is dedicated to the advancement of environmentally safe electronics manufacturing processes, equipment, materials and practices; flexible electronics manufacturing technologies; and workforce competency in advanced electronics manufacturing.

EMPF Web site: http://www.empf.org

Energetics Manufacturing Technology Center

The Energetics Manufacturing Technology Center (EMTC), established in 1994 by the Office of Naval Research (ONR), is Navy-operated and located at the Naval Sea Systems Command's Naval Surface Warfare Center (NSWC), Indian Head Division (IHD), Indian Head, MD. The Indian Head Division serves as the focal point for the Center and as a renowned leader in energetics, provides a full spectrum of capabilities. These include energetics research, development, modeling and simulation, engineering, manufacturing technology, production, test and evaluation, and fleet / operations support.

Energetic materials (reactive chemicals), formulations (propellants, explosives, pyrotechnics), and subsystem components (fuzes, detonators, boosters, igniters, safe & arm devices) are critical to the performance and reliability of weapon systems and thus to our Nation's defense. Applications include missile, rocket, and gun propulsion; stores or ordnance separation; warheads and munitions; obstacle and mine clearance; flares; decoys; fire suppression; and aircrew escape.

Energetics, inherently dangerous, require special processes, equipment, facilities, environmental considerations, and safety precautions. At EMTC, this is kept in mind while ensuring the availability of safe, affordable, and quality products. The Center develops solutions to manufacturing problems unique to military system / subsystem acquisition and production requirements and the energetics industry. The Center does not own or operate any facilities and equipment but is essentially a virtual enterprise that involves government, industry, and academia in identifying requirements and executing projects. EMTC objectives are to identify weapon system and manufacturing base needs, develop and demonstrate the required manufacturing process technology solutions, and transition successful results.

EMTC Web site: http://www.navsea.navy.mil/nswc/indianhead/codeCA/EMTC/main.aspx

Institute for Manufacturing and Sustainment Technologies

The Institute for Manufacturing and Sustainment Technologies (iMAST), established in 1995, coordinates Navy ManTech efforts at The Pennsylvania State University's Applied Research Laboratory (ARL), one of four U.S. Navy University Affiliated Research Centers (UARCs). Located in State College, PA, iMAST's primary objective is to address challenges related to Navy and Marine Corps weapon system platforms in the following technical areas: mechanical drive transmission, materials processing, laser processing, advanced composites, manufacturing systems, repair and sustainment, and complex systems monitoring. iMAST supports the Navy and Marine Corps systems commands, as well as PEOs and Navy laboratories.

REPTECH applies new and emerging technologies to improve capabilities of Navy depots, shipyards, Marine Corps Logistics Bases, and lower level maintenance activities throughout the Fleet. REPTECH cooperates and communicates with Navy COEs, the joint depot community, DOD industrial activities, industry, PEOs, and university laboratories.

iMAST Web site: http://www.arl.psu.edu/imast.html

Navy Joining Center

The Navy Joining Center (NJC), established in 1993, is operated by Edison Welding Institute (EWI) located in Columbus, OH. The NJC provides a national resource for the development of materials joining expertise and the deployment of emerging manufacturing technologies. Materials joining is a primary means of fabricating and maintaining the fleet, aircraft, weapons, and advanced electronics that are the core of modern Navy forces. The Center's goal is to improve the life-cycle affordability and mission capability of critical Navy weapon systems through the implementation of materials joining technology.

The NJC team represents a collaborative effort among industry, academia, and government, and is experienced in identifying joining problems, developing and deploying solutions, and transferring technology. The NJC disseminates project results and other joining information through demonstrations, workshops, conferences, publications, and a Joining Technology Information network.

Typical projects provide joining solutions for metallic, non-metallic, ceramic, and composite materials that support Navy ManTech strategic plans.

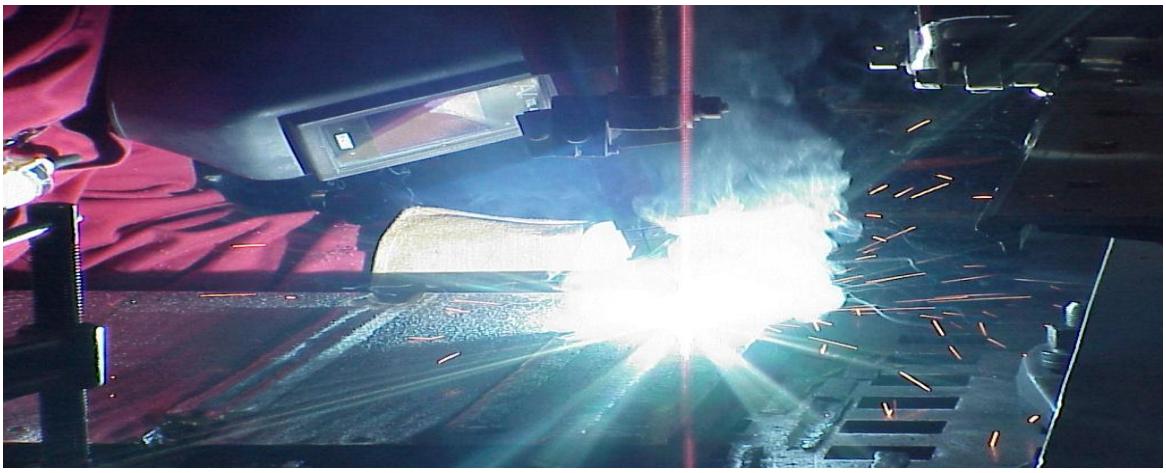
NJC Web site: http://www.ewi.org/njc

Navy Metalworking Center

The Navy Metalworking Center (NMC) is the national resource for the development and transition of advanced metalworking and manufacturing technologies, materials, and related processes. Established in 1988 to address Navy and DOD metalworking needs, NMC works in partnership with government, industry, weapon systems prime contractors, and Program Offices to develop and apply innovative technologies. NMC drives new technologies from research and development to naval weapon systems application with two objectives: (1) to implement new technologies that will improve weapon system performance; and (2) to develop new production means for weapon systems prime contractors and suppliers that lower the production and total ownership cost of naval weapon systems.

NMC has supported the Navy with affordable new metalworking technologies and capabilities that have responded to increasingly stringent requirements for greater agility, survivability, and lethality. NMC is operated by Concurrent Technologies Corporation (CTC), an independent, nonprofit organization located in Johnstown, PA.

NMC Web site: http://www.nmc.ctc.com



Navy ManTech Execution

Dissemination of Results

The emphasis of the Navy ManTech Program is on transition of manufacturing technology that will result in tangible benefits for the Fleet. To achieve transition, it is imperative that the manufacturing advances be widely disseminated to the industrial base for implementation. To foster that dissemination, Navy ManTech provides the following:

Program Web site

The **Navy ManTech Program Web site** can be accessed at http://www.onr.navy.mil/mantech/. The Web site is a central source for accessing general information about the program, program activities and participation, developments and events, and key points of contact. The site also offers links to the online annual Navy ManTech Project Book, program success stories, as well as other publications and reports.

Defense Manufacturing Conference

The annual **Defense Manufacturing Conference (DMC)** is a forum for presenting and discussing initiatives aimed at addressing DOD manufacturing technology and related sustainment and readiness needs. The conference includes briefings on current and planned programs, funding, DOD initiatives, and seminars relating to the various technology thrusts currently being pursued. Further details are available at the DOD Manufacturing Technology Web site at: https://www.dodmantech.com.

Project Book

The **Navy ManTech Project Book**, published annually and available through the Navy ManTech Web site, is a snapshot of Navy ManTech projects active during that particular fiscal year. Points of contact for each project are provided to facilitate technology transfer.

Centers of Excellence

The **Navy COEs** are focal points for specific manufacturing technology areas. The charter for each COE requires it to act as a consultant to both the Navy and industry and to facilitate the transfer of technology throughout the industrial base.

The Navy urges government activities, industry, and academia to participate in its ManTech Program as participants, advisors, consultants and, most importantly, as beneficiaries. The goal of developing and implementing new and improved technologies will be achieved only through a concerted effort by everyone connected with the design, manufacture, and repair and sustainment of naval weapon systems.

For additional information on participation in the Navy's effort to strengthen the U.S. industrial base, impact platform affordability, and increase Navy readiness, contact any of the Navy ManTech Points of Contact who are listed on pages 20-28.

ManTech: Expanding Success at Facilitating Acquisition Cost Reduction / Avoidance to Focus on Total Ownership Cost Reduction

The four major shipbuilding acquisition platforms (VCS, CVN 78 Class carrier, LCS, and DDG Destroyer Family) and the Joint Strike Fighter (JSF) that ManTech focuses on for affordability.

… transitioning affordable manufacturing technology to the Fleet

ManTech: Expanding Success at Facilitating Acquisition Cost Reduction / Avoidance to Focus on Total Ownership Cost Reduction

AT A GLANCE

WHAT IT IS

- Navy ManTech's focused VIRGINIA Class submarine affordability initiative is developing and transitioning manufacturing technology for implementation on the factory floor to result in significant cost savings.

HOW IT WORKS

- Navy ManTech works closely with PEO (Subs), PMS 450, General Dynamics Electric Boat, and Huntington Ingalls Industries – Newport News to focus ManTech resources on developing needed manufacturing technology.

WHAT IT WILL ACHIEVE

- To date, 21 of ManTech's projects have implemented on the factory floor for $19M/hull cost savings (GD Electric Boat figure – May 2011).
- Additional projects in work and in the pipeline for future implementation.
- Projecting $35.3M/hull cost savings total.

Reducing the total ownership cost of current and future platforms is a critical goal of the Navy. Over the past six years, the Navy ManTech Program has been focused largely on acquisition affordability improvements for key major acquisition platforms. ManTech has helped these Navy programs achieve their respective affordability goals by transitioning needed manufacturing technology which, when implemented, results in a cost reduction or cost avoidance (measured as $/hull).

A major success for Navy ManTech has been our VIRGINIA Class submarine (VCS) affordability initiative. Extensive interaction and cooperation between Navy ManTech, Navy ManTech Centers of Excellence (COEs), General Dynamics Electric Boat, Huntington Ingalls Industries – Newport News Shipbuilding, PEO (Subs), and the PMS 450 Program Office has resulted in a focused ManTech initiative that is successfully transitioning and implementing technology to aid in the Navy's and industry's common goal to reduce the cost of each VCS from $2.4B to $2.0B (FY05 $) enabling the construction of two submarines per year in 2012.

*"There are several **key partners** in the success of the VIRGINIA Program and its cost reduction achievements. **ManTech has been a critical partner to industry,** who not only contributed valuable funding, but also fostered the identification and incubation of enabling manufacturing technologies which ultimately improved the VIRGINIA Class build plan. **Without their support, much of the inherent savings associated with many new cost reduction ideas would not have happened.**"*

—John Holmander, Vice President
VIRGINIA Class Program,
General Dynamics Electric Boat

The current ManTech portfolio contains approximately 70 completed, active, or pending projects and has a potential acquisition cost savings of over $35M per hull for a return on investment in less than two hulls (from ManTech's Feb 2011 Affordability Assessment which was vetted through PMS 450). To date, twenty-one of the ManTech affordability projects have implemented or are in the process of implementation. Realized cost savings/ hull of approximately $19M have been recognized by the VIRGINIA Class Program Office and General Dynamics Electric Boat. These real acquisition cost savings for VCS have been negotiated into the Block III VIRGINIA Class submarine procurement, and a process has been established to achieve further savings during future submarine acquisition processes.

With a history of success in helping to facilitate acquisition cost reduction / avoidance for key Navy platforms, Navy ManTech is now turning our attention from primarily acquisition cost reduction / avoidance to total ownership cost (TOC) reduction.

In addition, we have expanded our investment strategy to include DDG 51 as a primary platform and have initiated a secondary effort targeted on the Joint Strike Fighter (F-35) in a coordinated portfolio with the DOD and Air Force ManTech Programs.

"We are making TOC a part of all our decisions."

—ADM Gary Roughead, Chief of Naval Operations,
"CNO Guidance for 2011 – Executing the Maritime Strategy"

Automated Fiber Placement for BMI for JSF – An Initial Implementation Success from New JSF Affordability Initiative

As part of Navy ManTech's new Joint Strike Fighter (JSF) affordability initiative, Navy ManTech teamed with Lockheed Martin Aerospace, Hitco Carbon Composites, MAG Cincinnati, and Cytec Engineered Materials to optimize the automated fiber placement (AFP) process for the carbon fiber bismaleimide (BMI) material used for the JSF wing skins to reduce weight and improve operational performance. Through the ManTech effort, the team determined material, machine, and process interactions in the manufacturing environment to enhance productivity and make the fabrication of wing skins and nacelle structure more affordable.

With an investment of approximately $3M, this effort led to increased lay-down rates of BMI AFP fabrication for both the wing skins and nacelle structure and eliminated the need for additional composite fabrication machinery and tooling. The manufacturing protocols and support fabrication technology were inserted real-time into the production of flight hardware for all three versions of the JSF aircraft - CV, STOVL, and CTOL.

> *"ManTech's $3M investment in BMI placement has produced substantial efficiencies in our manufacturing processes. This includes a 50% reduction in part cycle time and 300% improvement in fiber lay-down rates. These efficiencies stand to not only reduce aircraft production costs, but also reduce the need for additional composite machinery and tooling. In all, the efficiencies gained through this ManTech initiative are expected to reduce F-35 program costs by $100M over the next 25 years."*
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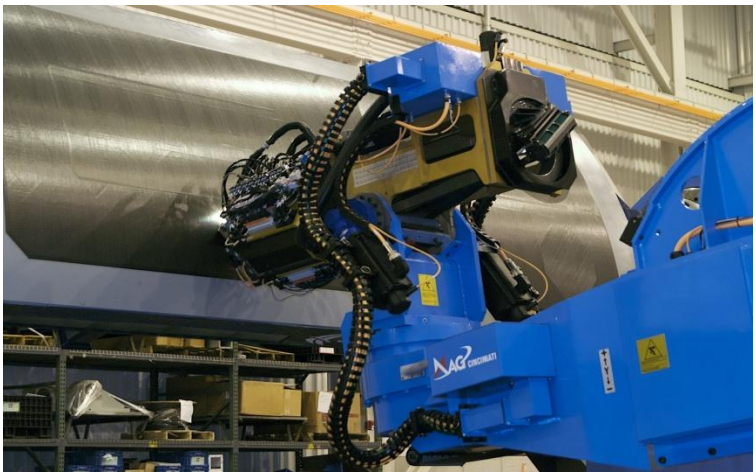
> *—VADM David J. Venlet, Program Executive Officer – F-35 Lightning II Program, 30 September 2011*



The VIRGINIA Class submarine California SSN 781 under construction at Huntington Ingalls Industries - Newport News.

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NAVY MANTECH
Manufacturing Technology Program

CVN 78 Class / Carriers Projects

New Watertight Door is Lightweight and is Expected to Reduce 30 Year Maintenance Costs by approximately $5M per Carrier

PERIOD OF PERFORMANCE:
June 2004 to September 2012

PLATFORM:
CVN 78 Class / Carriers

AFFORDABILITY FOCUS AREA:
Welding and Joining

CENTER OF EXCELLENCE:
iMAST

POINT OF CONTACT:
Mr. Timothy D. Bair
(814) 863-3880
tdb14@psu.edu

STAKEHOLDER:
PMS 378

TOTAL MANTECH INVESTMENT:
$3,918,000

S2031 — Advanced Surface Ship Watertight Enclosures

Objective

Navy standard watertight doors (NSWTDs), designed in the early 1950s, are expensive to maintain and are too heavy for today's needs. Watertight doors are usually at or near the top of the Navy's Top Management Attention (TMA) list for hull, mechanical, and electrical (HM&E) systems requiring frequent maintenance due to poor functioning, corrosion, and loss of water-tightness. The objective of the project is to specify a new interior watertight door featuring improvements over the NSWTD, while incorporating advances in materials, design, and manufacturing processes including, but not limited to: use of stainless steel, a novel laser fabricated metal honeycomb core sandwich panel, a new hydraulically actuated seal system, a distortion-reducing plug-in-hole frame, and highly accurate, high-speed, automated laser cutting and welding processes. In 2007, an additional objective -- to reduce the cost of NSWTDs --was added. To maximize insertion and retrofit opportunities, this project focuses on the 26 inch x 66 inch, 10 lbs per square inch interior door, weighing 292 pounds, with eight dogs (latches) and a 6-inch diameter window.

This effort, to date, has been primarily Navy ManTech funded although additional funding was awarded in FY11 from Office of Naval Research's (ONR's) Technology Insertion Program for Savings (TIPS) and the Swampworks.

Payoff

The weight of the new door is 213 lbs, representing a 27% reduction when compared to the NSWTD. Reducing the weight of the doors allows increased alternate weight allocation opportunities for armor, ordinance, cargo, and other warfighting-related functions. Reduced maintenance costs due to low distortion plug-in-hole installation and the use of a more corrosion-resistant material (304 stainless steel) than the low carbon steel (A-36) used in the NSWTD, combined with reasonable manufacturing costs, will result in a reduction of total ownership costs, thereby providing more resources for the warfighter. A reduction in maintenance cost of 80% is estimated resulting (for an aircraft carrier with approximately 460 watertight doors) in a savings over a 30 year lifetime of $5.52M per carrier.

Implementation

Certification testing, in accordance with ABS Naval Vessel Rules, is in progress and is led by the Naval Surface Warfare Center, Carderock Division – Ships Systems Engineering Station (NSWCCD-SSES). Certification tests include hydrostatic, cyclic, vibration, fire, and EMI tests. The new door has passed the hydrostatic test and the cyclic test. Vibration, shock, fire and EMI tests remain to be scheduled.

Two doors were installed on the USS Porter, a destroyer, in September 2010 for one year at-sea evaluation. Sponsored by ONR's TIPS program, four additional doors have been installed for one year at-sea evaluations, i.e. two on the USS Wasp (LHD-1) in October 2010 and two on the USS Monterey in November 2010. So far, feedback from the installations and at sea evaluations has been positive.

Optimized Welding for Thin Panels Expected to Result in Cost Reduction of $2.4M per Hull for CVN 78 Class Carriers

S2198 — Control of Thin Panel Distortion

Objective

Lighter weight designs for sponsons, decks, bulkheads, and other structures for the CVN 78 Class aircraft carrier require more lightweight plates and panels in comparison to CVN 77 structures. Thin complex panels produce more welding distortion which, in turn, increase manufacturing costs and reduce production throughput. This project is assessing the specific needs of Huntington Ingalls Industries - Newport News Shipbuilding (NNS) panel and final assembly fabrication processes. The project focuses on improving current panel fabrication processes; developing and demonstrating new processes and methods; and determining implementation strategies for high mix thin structure panel production for CVN 78 and future ships. New technologies and lessons learned from previous Navy ManTech work will be leveraged to reduce development costs. The distortion control technology that is implemented will minimize cost increases for complex thin panel structures.

Payoff

For CVN 78, implementation of project recommendations will impact cost targets associated with production hours for dimensional control of all ship structures. In 2007, when the project planning document (PPD) was written, for CVN 77 this was conservatively estimated at 156,000 man-hours (78,000 for flame straightening of final assembled units; and 78,000 for correcting distortion to make units fit together). For CVN 78, these hours are estimated to increase by 30% to 202,800 hours, and NNS is expected to spend $12,168K correcting thin plate distortion. The project will target a 20% reduction in these man-hours for an estimated cost benefit of $2,434K/hull. Potential benefits from this project will be applicable to all naval ships constructed from stiffened plate panels. The business case analysis will be updated in July 2012 when the project ends.

Implementation

Project results support construction of CVN 78 Class aircraft carriers and the cost reduction goals of NNS. The implementation site for the developed technology is NNS. Results of the business case analysis will provide justification for NNS commitments to implement the results of the project. Implementation of project results is anticipated for the fabrication of CVN 79 Class components in 2013, approximately one year after project completion.

PERIOD OF PERFORMANCE:
April 2008 to July 2012

PLATFORM:
CVN 78 Class / Carriers

AFFORDABILITY FOCUS AREA:
Facilities and Industrial Processes

CENTER OF EXCELLENCE:
NJC

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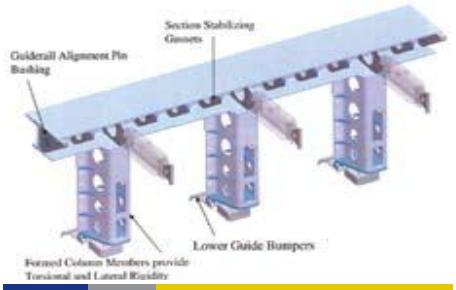
STAKEHOLDER:
PMS 378

TOTAL MANTECH INVESTMENT:
$1,885,000

Improved Brake Pad Materials for the Electromagnetic Aircraft Launch System (EMALS)



PERIOD OF PERFORMANCE:
January 2009 to September 2011

PLATFORM:
CVN 78 Class / Carriers

AFFORDABILITY FOCUS AREA:
Metals Processing and Fabrication

CENTER OF EXCELLENCE:
iMAST

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STAKEHOLDER:
PMS 378

TOTAL MANTECH INVESTMENT:
$350,000

S2249 — CVN Manufacturing Support for EMALS

Objective

The high wear rate of the Electromagnetic Aircraft Launch System's (EMALS) forward bogey shuttle drag brake on the CVN 78 Class carrier was identified as an issue by General Atomics (GA), the EMALS prime contractor. Based on wear testing and simulated operational testing, it was determined that this original brake pad material would not last long enough to meet a specific number of launches in a 12 hour period in a certain operational scenario. Those pads would require 2 replacements during that period of time. Replacement time for the pads was estimated to be 2 to 3 hours. The project's objective was to identify alternative brake pad materials, test the material under simulated operating conditions and recommend an improved pad material.

Payoff

The Institute for Manufacturing and Sustainment Technologies (iMAST) examined the issue of reduced wear of the baseline brass wear pads for the EMALS launch system and selected a number of alternative metallic and nonmetallic replacement brake pad materials with emphasis on extending the useful life beyond this specific scenario's operational 12 hours period of time. Ni Al bronze was identified as a superior material for this application. The Ni Al bronze is predicted to last 3 times as long as the original material. The cost savings and avoidance per aircraft carrier is estimated at $1M. A reduction in maintenance cost will be realized by preventing repeated replacement of the replaceable brass brake pads. More importantly, it will prevent the need to replace the brake pad material during certain operational scenarios and thus extend the continuity of operations during those scenarios.

Implementation

iMAST recommended the Ni Al bronze as a superior replacement brake material and this recommendation was supported by NAVAIR. Follow-on wear testing at Lakehurst facility confirmed the iMAST results. General Atomic accepted the brake pad alternative material recommendation in 2011, and the Ni Al bronze brake pad material is now the baseline material in the EMALS design.

Recently, General Atomic proposed a new brake design, which their analysis shows will last 5 times as long as the old design. Using Ni Al bronze the new brake pad material should last as much as 15 times as long as the original material.

Digital Radiography Reduces Inspection Cycle Time

S2280 — Digital Radiography: Transition for Inspection of Welds and Castings

Objective

Through a previous ManTech project, "Digital Radiography Alternative to Film Radiography" and its follow-on implementation efforts, the Newport News Shipbuilding (NNS) team (formerly NGSB-NN) outlined a need for continued development of American Society for Testing and Materials (ASTM) commercial computed radiography standards for inspection of welds and castings, as well as ASTM digital reference acceptance standards for ferrous and non-ferrous castings. This project exists to ascertain inspection confidence with isotopes and high energy applications using Digital Radiography. Its aim is to provide a reliable, viable, and less costly replacement for film-based radiography that will: (1) resolve technical and implementation issues, (2) reduce environmental impacts and, (3) reduce inspection costs. The ultimate objective of this project is to develop a fully implemented digital computed radiographic (CR) imaging system that utilizes reusable phosphorescent plates requiring no chemical development and offering more convenient storage of electronic images

Payoff

Reduction in radiographic inspection cycle times associated with film development, handling, and storage operations is a major driving force for the adoption of this technology. For approximately 70% of NNS radiographic operations, the potential exists for significant improvement in inspection cycle time. This improvement is associated with the anticipated elimination of film development and manual transport of conventional radiographic materials, as well as related manual storage and retrieval of film / records. The estimated cost savings of this project is $1M - $1.5M per hull.

Implementation

Technology implementation is highly dependent on NAVSEA technical codes approving the CR standards for use. Implementation update on Center for Naval Shipbuilding Technology's (CNST) "Digital Radiography" project that was completed in late 2008, NNS received NAVSEA approval on a lower energy isotope, Selenium-75 (Se-75) to conduct radiography. The use of Se-75 reduces the 'exclusion area' around the radiography test, drastically reducing the interference / interruption impact on production activities, allowing radiography to be accomplished without adjacent work stoppage. This is applicable to all shipyards, valid for NAVSEA 250-1500-1 and TP-271 Radiography applications, for material thicknesses up to 1.6 inches; which enables an even greater range of Se-75 radiography shots. NNS has recently implemented this provision. Full implementation is not hull dependent, NAVSEA approval required. The implementation targeted timeframe is expected to occur during fourth quarter FY12 at NNS on CVN 78. GDEB is following project results for potential use on VIRGINIA Class submarine construction / repair.

PERIOD OF PERFORMANCE:
November 2010 to April 2012

PLATFORM:
CVN 78 Class / Carriers

AFFORDABILITY FOCUS AREA:
Metals Processing and Fabrication

CENTER OF EXCELLENCE:
CNST

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STAKEHOLDER:
PMS 378

TOTAL MANTECH INVESTMENT:
$535,000

Welding Preheat Control System to Reduce Costs in Controlling Temperatures and Rework

PERIOD OF PERFORMANCE:
November 2009 to November 2011

PLATFORM:
CVN 78 Class / Carriers

AFFORDABILITY FOCUS AREA:
Welding and Joining

CENTER OF EXCELLENCE:
NMC

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STAKEHOLDER:
PMS 378

TOTAL MANTECH INVESTMENT:
$856,000

S2291 — Remote Welding Preheat Control System

Objective

Preheating of welding assemblies is a common practice in shipbuilding. A minimum preheat temperature must be achieved to satisfy welding needs, but the upper limit may be bound by the temperature sensitivity of non-metallic materials that are packaged inside the welding assembly in certain applications. Currently, an operator manually controls the temperatures through the use of percentage timers or by plugging/unplugging the power cord and monitors the temperature by using “temp sticks” at each weld station to determine base metal temperature. With the current system, the assembly is susceptible to overheating, causing damage to the non-metallic material. Rework associated with cleaning and re-applying non-metallic material and addressing damaged weld assemblies causes significant additional cost and schedule delays. The objective of this project is to reduce labor costs associated with the control and monitoring of weld preheat temperatures and to reduce the risk of overheating non-metallic materials within a weld assembly. The Navy Metalworking Center is developing a prototype remote welding preheat control system that will demonstrate the capability to control the preheating process in a production environment. The prototype system can be modified and expanded for production use. The platform targeted for this project is the CVN 78 Class aircraft carrier.

Payoff

Implementation of a remote welding preheat control system will reduce costs associated with manually controlling welding preheat temperatures and diminish the risk of damage to weld assemblies containing non-metallic materials.

Specifically, full implementation can result in a cost savings of approximately $820K per hull. Also, the risk of damaging weld assemblies and the resulting cost and schedule impacts could be reduced. A recent failure of the current system cost approximately $45K for the assessment of the event’s cause and the scrapped material. After implementation, the system would support other Navy weapon system applications involving less heat-sensitive, but manually controlled, processes for pre-heated metals.

Implementation

Upon successful project completion, the Office of Naval Research will transfer ownership of a prototype control system to PMS 378. Additional activities must occur to permit implementation. Initially, PMS 378 must transfer custodianship and provide permission to Newport News Shipbuilding to modify / expand the prototype system and use it for the production of CVN 79. The modification / expansion of the control system includes procuring and integrating additional control stations that will permit control and monitoring of a larger quantity of heater bars. Once the additional control stations are integrated, production personnel must be trained on the use of the entire system. Implementation is targeted for second quarter of FY12.

Alternative Brazing has Potential Cost Savings of $1.9M

S2298 — Alternative Brazing for Shipboard Use

Objective

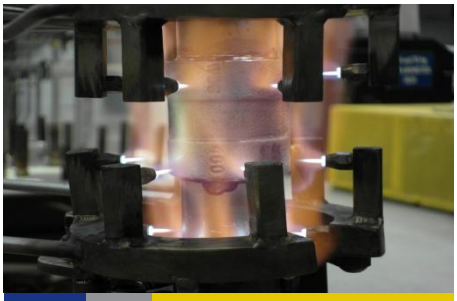
Newport News Shipbuilding (NNS) currently uses a hand-held torch to manually flame braze fittings shipboard. The use of a hand-held torch for this process is labor intensive because of the time required to reach melting temperature of the filler material. Additionally, the process causes occasional paint damage because it is difficult to control the flame and to negotiate the minimal clearances surrounding the fitting. The limited clearance also makes it difficult to achieve a uniform bond, which causes occasional pipe leaks. Paint damage and pipe leaks result in rework that further adds to the brazing costs. The goal of this Navy Metalworking Center (NMC) ManTech project is to develop a prototype flame brazing system to address these problems for CVN 78 Class aircraft carrier and Virginia Class submarine (VCS) construction. The new flame brazing technology will utilize a programmable logic controller, mass flow controllers, and a burner cage to surround the fitting.

Payoff

Using alternative flame brazing technology in this application is expected to reduce the time required to braze each joint, as well as the amount of rework related to manual torch brazing. This translates into significant labor and production cost savings. Implementing this alternative brazing technology will result in an estimated cost savings of $1.9M in the construction of three CVN and nine VCS hulls and the overhaul of six CVN hulls. This does not include NNS savings for using the technology in their shop or as a result of reduced training time to braze. The current five-year return on investment (ROI) is 1.1. In addition, the proposed solution may benefit other platforms requiring flame brazing.

Implementation

NNS will use the prototype to generate brazing procedures and qualification samples. NNS will test the qualification samples and provide the procedures and results to its Supervisor of Shipbuilding (SOS) for acceptance. Upon acceptance, the Office of Naval Research will transfer government ownership rights of the prototype to the PMS 378 Program Office. The transition signifies that a mechanized shipboard brazing system is capable for use in CVN and VCS construction and can be implemented at NNS. It is estimated that the prototype will be implemented into the CVN construction process at NNS by second quarter 2012.



PERIOD OF PERFORMANCE:
August 2009 to October 2011

PLATFORM:
CVN 78 Class / Carriers

AFFORDABILITY FOCUS AREA:
Welding and Joining

CENTER OF EXCELLENCE:
NMC

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STAKEHOLDER:
PMS 378

TOTAL MANTECH INVESTMENT:
$1,096,000

Evaluation of Thermite Welding Supports Use in CVN 78 and Possibly Fleet-Wide Applications

PERIOD OF PERFORMANCE:
March 2010 to February 2012

PLATFORM:
CVN 78 Class / Carriers

AFFORDABILITY FOCUS AREA:
Welding and Joining

CENTER OF EXCELLENCE:
NMC

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STAKEHOLDER:
PMS 378

TOTAL MANTECH INVESTMENT:
$1,575,000

S2330 — Exothermic Welding for CVN

Objective

The Future Aircraft Carrier Program Office supports the use of thermite (exothermic) welding for performing multi-cable, copper conductor splices for Navy shipboard power applications as a means of reducing total ownership cost. Thermite welding requires no external source of heat or current and is expected to reduce the total number of man-hours required for installation, as well as man-hours required for preventive and corrective maintenance. However, the process is currently not approved for Navy shipboard applications. The effects of shipboard environmental conditions on weld quality are not fully understood, and Navy and shipbuilder experience with the process is very limited. The objective of this Navy Metalworking Center (NMC) project is to thoroughly evaluate the proposed exothermic welding and insulation processes for splicing the Electro-magnetic Aircraft Launch System (EMALS) shipboard power cables and other applications on CVN 78 Class carriers. Shipboard installation and repair procedures will be developed and approved for use.

Payoff

Although life-cycle cost benefits associated with a more efficient multi-cable connection method are expected, there is no comparison data available to understand any cost impacts at the acquisition level. Qualitative benefits include reduced risk to quality and schedule; reduction in man-hours expected for installation as well as preventive and corrective maintenance of the EMALS cable system; increased system reliability and availability; and the creation of enhanced, repeatable, cost-effective installation and repair procedures. This project will potentially lead to a Fleet-wide process for splicing power cables, which is especially applicable to high-current applications, such as electric propulsion and pulse-energy systems.

Implementation

Newport News Shipbuilding (NNS) will implement the NAVSEA-approved procedures to complete installation of the EMALS on CVN 78 Class carriers in the third quarter of fiscal year 2013.

Temporary Protective Coating Will Save up to $1.5M per CVN 79 Hull During Construction

S2331 — Temporary Protective Coatings

Objective

Both Newport News Shipbuilding (NNS) and Ingalls Shipbuilding (Ingalls) have similar needs for temporary coatings to protect certain CVN and DDG 51 components during construction. This Navy Metalworking Center (NMC) project will indentify temporary coatings that will prevent or reduce damage and corrosion that occurs during the shipbuilding process, significantly reducing the labor currently needed to remove the corrosion or repair damage. The project team is investigating, modifying, and demonstrating temporary coatings / materials that can be easily applied and removed. Commercially available materials used in other industries may be used or adapted to meet established technical and cost-reduction goals.

Payoff

Implementing a temporary coating to protect an estimated 300,000 linear feet of exposed weld joint area on CVN 79 modules at NNS has the potential to save $1.04M to $1.54M per hull. This estimate includes a 50-70 percent reduction in labor and material costs for the temporary coating.

Implementing a temporary coating to protect non-skid during the construction of DDG 51 at Ingalls has the potential to save $150K per hull. This estimate is based on approximately $200K spent on non-skid repair due to damage and staining on previous hulls. This savings is also expected to impact DDG 113 and DDG 114, as well as possible future hulls. Results of this effort may also apply to LPD, LHA, CVN, and other vessels.

These benefits are preliminary and are expected to improve with procurement of additional DDG 51 hulls and implementation on other vessels not currently included in the benefits calculations.

Implementation

The transition point for this project will be shipbuilder acceptance and Future Aircraft Carrier Program Office concurrence of the implementation recommendations. After transition, and assuming the recommendations are to implement the materials, the implementing shipyards will develop the appropriate procedures and provide training for application and removal. Implementation is expected to occur on some CVN 79 modules in FY12; future DDG 51 Class vessels, DDG 113 and DDG 114; and LHA 6.

PERIOD OF PERFORMANCE:
March 2010 to March 2012

PLATFORM:
CVN 78 Class / Carriers

AFFORDABILITY FOCUS AREA:
Coatings

CENTER OF EXCELLENCE:
NMC

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STAKEHOLDER:
PMS 378

TOTAL MANTECH INVESTMENT:
$1,100,000

Lower Unit Cost Expected Through Improved Manufacturing of SEWIP System

PERIOD OF PERFORMANCE:
October 2010 – April 2012

PLATFORM:
CVN 78 Class / Carriers

AFFORDABILITY FOCUS AREA:
Electronic Processing and Fabrication

CENTER OF EXCELLENCE:
EMPF

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STAKEHOLDER:
PMS 378

TOTAL MANTECH INVESTMENT:
$2,718,000

S2340 — Low Cost Antenna Assembly for the Surface Electronic Warfare Improvement Program (SEWIP) Block 2 Electronic Warfare System

Objective

The intent of the Surface Electronic Warfare Improvement Program (SEWIP) Block 2 project is to upgrade the Navy's AN/SLQ-32 (V) electronic support measures system, which includes the system's receiver, antenna and combat system interface. The Lockheed Martin (LM) team has been selected by the U.S. Navy to provide the Integrated Common Electronics Warfare System (ICEWS) for SEWIP Block 2. This is a single enterprise solution designed to scale across all ship classes in the U.S. Navy's surface fleet. At-sea demonstrations of ICEWS in June 2009 were successful. The ICEWS maximizes the reuse of SEWIP Block 1 elements and leverages the LM Team's investment of $15M for a SEWIP Engineering Development Model (EDM) which was demonstrated at sea to achieve the lowest risk solution for Block 2. The ICEWS will upgrade the receiver and antenna capabilities, as well as the combat system interface, of the legacy surface EW system. Lockheed Martin's scalable enterprise approach to ICEWS is based on the company's Rapid Commercial Off-The-Shelf (COTS) Insertion program, which has been used successfully on EW and sonar system upgrades on all classes of U.S. Navy submarines.

The objective of this project is to achieve a lower unit cost through improved manufacturing and ruggedization of the COTS SEWIP system elements. This would allow the proposed elements to also meet the objectives of all SEWIP platforms including small ship Electronic Warfare (EW) systems, while improving producibility and lowering the unit cost for the standard SEWIP Block 2 System. This effort is targeted initially towards the CVN 78 Class carrier program; however, ship classes such as DDG 51 and DDG 1000 would also benefit from implementation.

Payoff

To address the desired cost targets for the project and improve COTS hardware that currently does not meet system producibility, this project has been developed to focus on the following: (1) improved manufacturability of the COTS Fiber Optic Transmitter, (2) improved manufacturability of the PDF Switch Matrix (RF Module), and (3) improved manufacturability of the RF Tuner. Implementation of the ManTech SEWIP developments is expected provide ~$1M per hull in cost savings.

Implementation

Lockheed Martin is targeting insertion of this project's low cost module into the SEWIP Block 2 EDM for CVN 78, which the Navy plans to begin procurement in 2012. Cost avoidance is expected to be achieved within the first four platforms. There is a total plan of 140 platforms, not including Littoral Combat Ship (LCS), that will benefit from this ManTech effort via the SEWIP Block 2 Effort. The LM Mission Systems & Sensors (MS2) team will integrate these elements as part of the two planned EDMs for SEWIP Block 2, providing a low risk transition approach.

Development of Cooling Solution to Prevent Paint Damage from Welding

S2356 — Prevention of Coating Damage During Hot Work

Objective

Small welds often are made late in the aircraft carrier construction phase after painting and outfitting have taken place. These welds can damage the paint on the opposite side of the structure being welded. Heat from welding can cause discoloration, delamination, charring, and smoking of the paint. In some cases, damage to the paint will not be readily observable from an examination of the area's surface. However, the damaged paint will likely fail prematurely. To preclude this damage, paint is often removed from the opposite side of the substrate prior to welding.

Newport News Shipbuilding (NNS) has identified approximately 60,000 hours of rework in tanks and staterooms due to final welds damaging the paint. This Navy Metalworking Center project identified modified welding procedures that will prevent coating damage during welding. The heat removal solution(s) developed in this project, in many cases, will keep the maximum temperature of the paint / steel interface below the threshold temperature that causes damage. These solutions, once approved, will result in modifications to existing welding procedures.

Payoff

The labor to remove paint prior to welding and to repair areas of damaged paint can be very extensive, especially late in the outfitting process. The results of this project are expected to reduce rework labor by approximately 15 percent and lead to an expected cost avoidance of more than $585,000 per ship. It is anticipated that these solutions will also benefit several other ship classes.

Implementation

The solutions developed in this project will likely appear as appendices to existing welding procedures. Ship fitters will likely be given the option to utilize the proposed cooling solution when welding certain combinations of wall thickness and attachment size. Implementation will take place after NAVSEA review / approval and after further testing at NNS to confirm repeatability of results. Implementation is targeted for the third quarter of FY12 at NNS during final outfitting of CVN 78.

PERIOD OF PERFORMANCE:
August 2010 to August 2011

PLATFORM:
CVN 78 Class / Carriers

AFFORDABILITY FOCUS AREA:
Coatings

CENTER OF EXCELLENCE:
NMC

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STAKEHOLDER:
PMS 378

TOTAL MANTECH INVESTMENT:
$506,000

Enhanced Electrode will Improve Survivability of Navy Combatant Ships at Reduced Cost

PERIOD OF PERFORMANCE:
December 2010 to February 2013

PLATFORM:
CVN 78 Class / Carriers

AFFORDABILITY FOCUS AREA:
Welding and Joining

CENTER OF EXCELLENCE:
NMC

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STAKEHOLDER:
PMS 378

TOTAL MANTECH INVESTMENT:
$976,000

S2372 — FCAW Electrodes with Improved Toughness

Objective

MIL-101TM flux-cored arc welding (FCAW) electrodes have exhibited inconsistent lot-to-lot notch toughness test values in production test welds, which have resulted in several instances of failure to pass the explosion test. Also, recent evaluations have found that the fracture toughness of MIL-101TM welds was lower than in welds made by other welding processes. Thus, there is a need for an improved MIL-101TM FCAW electrode with improved and more consistent notch toughness without reducing quality or operability. The Navy Metalworking Center (NMC) and Naval Surface Warfare Center, Carderock Division are evaluating candidate electrodes from leading electrode producers to support the qualification of these electrodes for CVN 79 structural welds and other critical applications

Payoff

The major benefit of this project will be improved survivability of Navy combatant ships. An additional benefit is a cost avoidance of up to $1.9M if the improved FCAW electrode is approved for welding designated critical applications on CVN 79. Also, the MIL-101TM electrode that is currently used costs approximately $6/lb. One of the proposed new electrodes costs approximately $2.50/lb. This would reduce electrode procurement costs by $1.75M per CVN if that particular electrode is selected for implementation.

Implementation

Once the improved FCAW electrode is approved by NAVSEA to be added to the Qualified Producers List (QPL) and the electrode is available commercially, implementation will occur when Newport News Shipbuilding begins to use the electrode in the construction of CVN 79 in the first quarter of 2014.

Manufacturing Improvements Could Save Significant Rework on Stores Elevator Doors

R2448 — Weapons and Stores Elevator Door Improvements

Objective

The new design of the weapons and stores elevator doors for the CVN 78 Class Aircraft Carrier is resulting in extensive rework due to thinner material and tight dimensional tolerances. Complicating this is a large number of unique door configurations per ship. The Navy Metalworking Center (NMC) is leading a rapid response project that is addressing fabrication issues and schedule impacts by evaluating alternative materials and construction processes, optimizing current manufacturing processes, and implementing design for manufacturing and assembly recommendations.

Payoff

For CVN 78, a significant number of additional fabrication and labor hours per door were expended due to construction rework and schedule delays. The projected benefits of this project include design for manufacturing improvements in cost, schedule, and quality that can be pursued for CVN 79 construction. A $6M cost savings/avoidance (30% reduction) is targeted per hull. Follow-on efforts will target improvements that can provide greater impact to CVN 79 and future construction.

Implementation

The results and recommended improvements from this project will be evaluated for implementation viability, cost savings, quality improvement, and schedule reduction. The immediate down-selected improvements will be transitioned to Newport News Shipbuilding to incorporate into CVN 78 construction processes, documentation and procedures in late 2011 and 2012. A follow-on project is anticipated to validate, demonstrate, and implement more significant improvements for future construction on CVN 79 and beyond.

PERIOD OF PERFORMANCE:
March 2011 to October 2011

PLATFORM:
CVN 78 Class / Carriers

AFFORDABILITY FOCUS AREA:
Automated Tools

CENTER OF EXCELLENCE:
NMC

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STAKEHOLDER:
PMS 378

TOTAL MANTECH INVESTMENT:
$157,000

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NAVY MANTECH
Manufacturing Technology Program

DDG Family Projects

Low Cost Pallet System Manufacturing Improvements Will Save $6M per DDG 1000 Hull

PERIOD OF PERFORMANCE:
May 2007 to November 2010

PLATFORM:
DDG Family

AFFORDABILITY FOCUS AREA:
Metals Processing and Fabrication

CENTER OF EXCELLENCE:
NMC

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STAKEHOLDER:
PMS 500

TOTAL MANTECH INVESTMENT:
$1,961,000 (Phases 1 & 2)

S2132-1-2 — Low Cost Pallet Systems Phase 1 and 2

Objective

DDG 1000 will be equipped with two Advanced Gun Systems (AGS) manufactured by BAE Systems. Both systems utilize the EX-813 AGS pallet to package, handle, store, and transport the Long-Range Land Attack Projectile (LRLAP) munitions and charges through the Navy logistic channels and within the AGS magazine in the DDG 1000 hull. The first phase of this project culminated in a set of recommendations and accompanying technical data package of potential product manufacturing improvements. The second phase demonstrated the various improvement recommendations in a series of representative prototype sample builds. The project focused on manufacturing a sample of the leading set of manufacturing improvement recommendations to confirm the manufacturing costs and to validate the functionality of the article. Overall, the primary objective of the project was to reduce manufacturing cost and system weight of the AGS pallet assembly by 10 percent ($35.4K per pallet) without compromising system performance.

Payoff

The project achieved a 12 percent reduction in manufacturing cost, which equates to a $6M per hull savings (150 pallets per hull @ $41K per pallet), and a 190-pound-per-pallet reduction in system weight that will improve the safety and survivability of the AGS pallet system.

Implementation

The Navy Metalworking Center (NMC) optimized the selected manufacturing approaches developed during Phase 1, including improved gas tungsten arc welding joint design and welding techniques, along with advanced machining and casting of critical projectile and propellant assembly system parts. The project produced a prototype AGS pallet system, and a Technical Data Package of proven manufacturing improvements and cost reductions was delivered to BAE Systems and NAVSEA PEO IWS 3C in November 2010 for implementation into the Low-Rate Initial Production (LRIP) of the AGS Pallet System in FY2011.

Note: Phases 1 and 2 were combined in this write-up.

Manufacturing Protocols Reduce the Cost of Large Area, Low Observable DDG 1000 Radomes Atomic

S2168 — Low Cost Manufacturing Technology for Very Large Format Low Observable DDG 1000 Radomes

Objective

Future ship communications and radar systems require very large scale low observable (LO) radomes for mission success. Consequently, future ship radome designs require large scale Frequency Selective Surface (FSS) structures and laminate materials with tolerances held to values that are state-of-the-art. The large size of proposed DDG 1000 installations will require material seams, electrical grounding, embedded treatments and integrated anti-ice grids. To achieve the desired radome radio frequency (RF) performance levels, laminate defects must be minimized and laminate thickness must be maintained within thousandths of an inch over the entire radome surface area.

The cost of these radomes can exceed a half million dollars each, and has become a significant portion of the DDG 1000 communications and radar system cost. In order to reduce radome acquisition costs, production radome fabrication yields must be pushed to nearly 100 percent. The objective of this project was to reduce radome costs and maintain delivery schedules via maintaining production radome fabrication yields near 100 percent. This aggressive fabrication goal can be accomplished with hand lay-up autoclave cure manufacturing methods, that integrate tailorable ply kits and optimized debulk cycles with both geometric and volumetric in-process non-destructive inspection. Robust repair protocols must also be developed to meet the necessary yields.

Payoff

The next generation LO large format radomes for Joint Maritime Force Ships require advances in manufacturing technology. The estimated cost of the radomes for DDG 1000 platform exceeds $12M per ship. The demonstrated manufacturing techniques will improve yields by 20%, realizing a minimum cost avoidance of $2.4M per ship. The projected total cost avoidance for DDG 1000 (three ships) is $7.2M and the total Return on Investment (ROI) 2:7. To date, Raytheon has documented $700K of cost savings for the initial build of DDG 1000 radomes for the first ship.

Implementation

This project developed manufacturing protocols which transitioned to the ZUMWALT class ships in 2009. Major project tasks were demonstrated in 2008 on prototype radomes and in 2009 on production radomes. A final project review was held in September 2010 where the protocols and project accomplishments will be presented to the aperture and ship community. The DDG 1000 deckhouse internal working group will be used to facilitate this transition. In the case of extremely high frequency (EHF), TxRx, cooperative engagement capability (CEC) secondary, identification friend or foe (IFF), and SPY-3 (multi-function) radomes, Raytheon APC is either the design or manufacturing agent. This manufacturing technology will directly impact the first two ship deliveries. Additional radome apertures that will benefit from this technology include the volume search radar (VSR), multi-function mast (MFM), UHF, and HF. The additional technology partners include PMS 500, Johns Hopkins / Applied Physics Laboratory, Lockheed-Martin, and Applied Aerospace Structures Corporation. In November 2010, the Integrated NDI protocol was implemented on Panel #4 of the first production VSR radome. This window was nondestructively inspected with a modified version of the NDI protocol developed under the ManTech program. The window successfully passed both requirements for geometric thickness tolerances and volumetric defects. This project is a joint effort with Composites Manufacturing Technology Center (CMTC).

PERIOD OF PERFORMANCE:
October 2006 to December 2010

PLATFORM:
DDG Family

AFFORDABILITY FOCUS AREA:
Composites Processing and Fabrication

CENTER OF EXCELLENCE:
iMAST and CMTC

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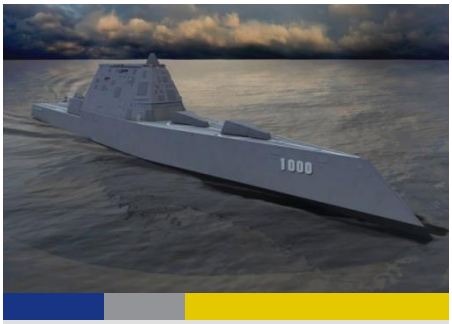
STAKEHOLDER:
PMS 500

TOTAL MANTECH INVESTMENT:
$655,000

Manufacturability Improvements Enabling Production of Large Area, High Strength Spinel Windows



PERIOD OF PERFORMANCE:
May 2010 to March 2012

PLATFORM:
DDG Family

AFFORDABILITY FOCUS AREA:
Facilities and Industrial Processes

CENTER OF EXCELLENCE:
EOC

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STAKEHOLDER:
PMS 500

TOTAL MANTECH INVESTMENT:
$926,000

S2293 — Large IR / Visible Window Manufacturing Technology

Objective

Current manufacturing technology for large area, high strength windows that feature high optical quality in the infrared (IR) and visible spectral band does not suffice for next generation Navy surface vessels. Monolithic spinel ($MgAl_2O_4$) offers the best combination of mechanical strength, IR / visible transmission properties to meet the requirements for the targeted shipboard applications. This project is focused on the development of manufacturing process improvements for producing large area (27”x19”x0.5”) spinel windows that exhibit sufficient mechanical strength to operate in a maritime environment and offer near-theoretical optical transmission in the mid-IR and visible spectrum. The Electro-Optics Center (EOC) is managing a subcontract with Technology Assessment & Transfer, Inc., to advance today’s monolithic spinel window manufacturing technology to meet the needs of DDG 1000 and future Navy ship applications.

Payoff

The project will yield 27”x19”x0.5” spinel window prototypes, approximately doubling the size of current windows produced by a hot press / hot isostatic press (HP/HIP) process. A design-of-experiment study will optimize the process parameters affecting the mechanical strength and optical quality. This project lays the foundation to manufacture and optically fabricate even larger area IR / visible windows for future Navy ships.

Implementation

The prototype monolithic spinel window to be fabricated under this project will be implemented on the DDG 1000 Zumwalt destroyers Component Electro-Optic Window Enclosure (CEWE). Future Zumwalt class vessels will employ spinel windows manufactured utilizing the optimized spinel process and optical fabrication methods developed under this project. Other future platforms will require similar large area spinel windows that can be manufactured with this project’s processes. Implementation is planned for FY15 on DDG 1000, FY17 for DDG 1001.

Rapid-Cure Deck Coating Expected to Reduce Schedule Delays

S2297 — Rapid-Cure Deck Coating

Objective

With current long-cure multi-coat systems, access to passageways and compartments is compromised for 7-10 days, reducing manufacturing efficiencies in outfitting and other projection areas. Having passageways and compartments off-limits can have a multiplying effect on downstream operations and can have an adverse affect on ship delivery schedule. The development of rapid-cure deck coating would enable foot traffic within 4-8 hours of coating application, thereby reducing manpower during new build and repair operations and reducing schedule risk associated with long-cure times.

In this project, extended durability deck coating formulations and surface tolerant coatings will be investigated. Surface tolerance to oil contamination and moisture will be investigated for primer and single-coat systems. The objective of this project is to identify or develop rapid-cure interior deck coatings capable of meeting the requirements of Mil-PRF-24613A (SH), Mil-PRF-32171A, and Mil-PRF-23236C. This goal will be accomplished using a dual-path approach. Commercial of the shelf (COTS) coatings and novel high-performance resin system formulations will be investigated to arrive at a resin system capable of meeting project requirements

Payoff

Acquisition cost avoidance of $200K per hull (DDG 1000) is anticipated as a result of implementing this project (data provided by Northrop Grumman Ship Systems (NGSS)). Similar cost savings are expected for repair and refurbishment. In addition to manpower savings, deck coating durability will have a substantial impact on life-cycle maintenance costs.

Implementation

Results of the Rapid-Cure Interior Deck Coating project will be implemented on the DDG 1000 or DDG 51 Restart program after demonstration of technology success and acceptance of the technology by the acquisition Program Office (PO) and/or the management representative of the industrial facility as well as the relevant Navy Technical Codes. This technology can be used in other platforms such as CVN, LHA, LHD and all surface ships. Implementation results will be provided 1st quarter FY13.

Rapid-Cure Interior Deck Coatings

PERIOD OF PERFORMANCE:
July 2009 to September 2012

PLATFORM:
DDG Family

AFFORDABILITY FOCUS AREA:
Coatings

CENTER OF EXCELLENCE:
iMAST

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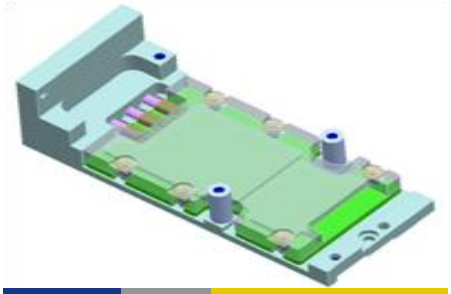
STAKEHOLDER:
PMS 500

TOTAL MANTECH INVESTMENT:
$225,000

Cost Reduction Efforts for Future VSR Antenna Addressed



PERIOD OF PERFORMANCE:
July 2009 to May 2012

PLATFORM:
DDG Family

AFFORDABILITY FOCUS AREA:
Electronic Processing and Fabrication

CENTER OF EXCELLENCE:
EMPF

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STAKEHOLDER:
PEO IWS
PMS 500

TOTAL MANTECH INVESTMENT:
$2,454,405

S2317 — Next Generation VSR Solid State LRU

Objective

The development of the S-Band Volume Search Radar (VSR) solid state phased array antenna was started in 2004 by Lockheed Martin (LM) for insertion into the DDG 1000 Zumwalt class destroyer. Using this technology, Lockheed Martin is presently preparing for production of two ship sets of antennas (three per ship) for the CVN 78 and CVN 79 program.

The S-Band Active Electronically Scanned Antenna (AESA) architectures and solid state technology began in the late 1990's by Lockheed Martin. One of the most critical components in a solid state AESA is the T/R module. The module technology drives both performance and the cost of the antenna. The T/R module in Lockheed's VSR antenna uses a mature ceramic module, with low voltage & high voltage (HV) GaAs HPA MMIC chip and wire technology.

Working together, the Electronic Manufacturing Productivity Facility (EMPF) and Lockheed Martin will lower the system cost of the VSR antenna by incorporating lower cost packaging technology and manufacturing approaches to reduce the T/R module cost by greater than 35%. With approximately 3000 T/R modules per antenna and three antennas per system, the T/R module costs make up a substantial fraction of the cost of an antenna. The lower cost system is now planned to be inserted on the DDG 51 cutover to the Advanced Missile Defense Radar (AMDR) system.

Payoff

The goal of this project is to reduce the module cost by >35%. This will be accomplished by reducing material and manufacturing labor costs during assembly and test. Material costs will be saved by switching from chip and wire in ceramic packages (that require special assembly lines) to plastic Quad Flat No-Lead (QFN) packages that are assembled on a standard printed wiring board production line. Manufacturing labor costs during assembly and test will be reduced by using known good QFN packages that are surface mounted to PWBs using automated surface mount assembly equipment. Use of pre-tested QFN packages and automated visual inspection stations will also reduce module re-work and will result in a higher module yield. The cost reduction is projected to be $6M/ CVN hull.

Implementation

Lockheed Martin will build 18 Low Power Modules (LPM), designed for the VSR T/R module, using plastic QFN packages that are surface mounted to Printed Wiring Boards (PWBs). These 18 LPMs will undergo performance testing before and after accelerated aging to demonstrate the reliability of the plastic QFN packaging. Furthermore, the plastic packaged LPMs will be directly compared to LPMs made with the high cost, ceramic packages.

At this point, the LPMs with plastic packages would be ready for incorporation into complete T/R modules to perform module testing at the Line Replacement Unit (LRU) level, and finally subsequent testing and qualification at the antenna level. Upon a successful development project, successful module and LRU performance testing, and successful antenna level testing where the modules prove to be as robust as the existing VSR production modules, a transition to full production and implementation could begin.

Lockheed Martin IRAD will fund the LRU testing, and PEO IWS 2.0 will fund the qualification at the antenna level and the ECP for the VSR or AMDR system for the DDG 51. Implementation will occur at Lockheed Martin, Bath Iron Works, and Newport News Shipbuilding.

Automated Back Gouging has Potential Cost Savings of $1M for DDG 1000

R2335 — Automated Back Gouging of Thick Plate

Objective

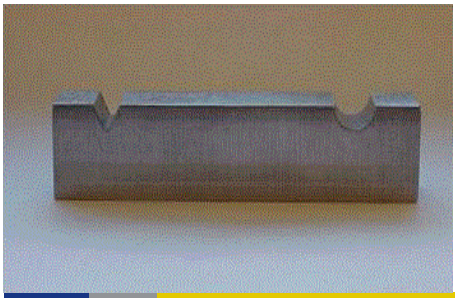
Bath Iron Works (BIW) manually arc gouges and grinds the Peripheral Vertical Launch System (PVLS) and Anti-Propagation Wall (APW) plates on DDG 1000 to produce the desired weld joint profile and quality. This labor-intensive process is slow, and the repetitive motion causes numerous injury claims, such as carpal tunnel syndrome. This project developed an automated back gouging tool that leveraged work done in a previous Navy Metalworking Center (NMC) project that developed a track weld shaver system to remove weld protrusion. That system was first modified to create a prototype tool that was successful in back gouging thin plates requiring a shallow profile depth (¼ to ½ inch). In order to meet the DDG 1000 back gouging requirements for PVLS and APW, a weld shaver was then modified with a larger diameter slotting cutter, a redesigned housing, as well as drive and guide wheels in order to be able to back gouge to a depth of 1-1/2 inches. As a result, a prototype took for thick plate gouging was developed and the Integrated Project Team witnessed the successful deep gouge demonstration and made recommendations for improvements for future tool improvements.

Payoff

Implementation of the back gouging tool for DDG 1000 has reduced direct labor cost by 75% for APW and PVLS joints. Injury claims associated with manual grinding and carbon arc gouging have been significantly reduced. In addition, reworks of weld joints due to defects discovered during ultrasonic inspection have also been significantly reduced. As a result, BIW has estimated a labor savings of approximately $400K per DDG 1000. The total cost savings for all DDG 1000 production is in excess of $1M. In addition, if mechanized back gouging can be introduced at Ingalls Shipbuilding for LHA, LPD, and NSC applications, an additional estimated savings of approximately $1.4M may be realized.

Implementation

The prototype back gouging tool was successfully demonstrated at BIW in August 2010. This was considered the transition event for the technology. This event verified tool life and operational cost, which will enable Ingalls to complete its economic analysis of mechanical back gouging and potentially lead to the implementation of this technology for back gouging applications associated with LHA, LPD, and NSC ship production. The tool was implemented at BIW in October 2010 to support DDG 1000 construction during the fabrication of PVLS and APW components. The tool continues to operate in the demanding shipyard production environment with almost no incidents of breakdown or repair. BIW has completed the training of operators to safely and productively operate the mechanical back gouging tool. The tool is fully supported by the commercialization vendor – PushCorp, Inc.



PERIOD OF PERFORMANCE:
April 2010 to November 2010

PLATFORM:
DDG Family

AFFORDABILITY FOCUS AREA:
Facilities and Industrial Processes

CENTER OF EXCELLENCE:
NMC

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STAKEHOLDER:
PMS 500

TOTAL MANTECH INVESTMENT:
$115,000

Mechanized Plate Edge Preparation System to Save $2.5M per DDG 1000 Class Hull

PERIOD OF PERFORMANCE:
December 2010 to January 2013

PLATFORM:
DDG Family

AFFORDABILITY FOCUS AREA:
Automated Tools

CENTER OF EXCELLENCE:
NMC

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STAKEHOLDER:
PMS 500

TOTAL MANTECH INVESTMENT:
$1,567,000

S2373 — Plate Edge Preparation Improvements

Objective

During ship fabrication, rust and primer must be removed from the weld joint areas of steel plates to be welded. Currently, edge preparation is done manually using a pneumatic stone grinder or sander. This is a slow, labor-intensive process causing numerous vibratory and carpal tunnel injuries. The current production rate at Bath Iron Works (BIW) is approximately 10 feet per hour and generates approximately 15 injury claims per year. Since there are several thousand plates per ship, with several edges per plate requiring preparation, a slight improvement in production could provide a substantial labor savings. In order to improve the plate edge preparation process, a prototype tool will be developed to increase the production rate and reduce injury claims. This will be accomplished by developing appropriate surface preparation and manipulation equipment, integrating the two technologies into a prototype system, and utilizing the prototype for production of DDG 1000.

Payoff

BIW estimates a 25 percent increase in production rate and a potential cost savings of $2.5M per hull. The first ship in the class (DDG 1000) will be nearly 80% complete for major plate welding at the time of earliest technology implementation. Therefore, 20% of the potential savings can be realized on this hull. DDG 1001 will be approximately 20% complete, so 80% of the cost savings can be applied to that hull. This results in a total cost savings of $5.0M for the three planned DDG 1000 hulls. Furthermore, the technology has the potential to reduce shipyard injury claims by 50 percent during DDG 1000 class construction. This technology can be implemented on other platforms, such as DDG 51 and CVN 78 class. BIW estimates that a 25 percent increase in production rate could result in a cost savings of $1.5M per DDG 51 hull.

Implementation

Prototype operation will be demonstrated at BIW and Ingalls Shipbuilding. Government ownership rights of the prototype will be transferred from ONR to PMS 500 for use at BIW in the first quarter of FY13 on DDG 1000.

Table of Contents

NAVY MANTECH
Manufacturing Technology Program

LCS Projects

Flexible Antenna System Leads to Reduced Cost and Reduced Number of Antennas

PERIOD OF PERFORMANCE:
April 2007 to April 2011

PLATFORM:
LCS

AFFORDABILITY FOCUS AREA:
Electronics Processing and Fabrication

CENTER OF EXCELLENCE:
EMPF

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STAKEHOLDER:
PMS 501

TOTAL MANTECH INVESTMENT:
$3,115.000

S2126 — Flexible Antenna System for Littoral Combat Ship Phase 2

Objective

The requirements for the next generation shipboard communications equipment needed to support multiple mission scenarios include performing the following roles: intelligence gathering, surveillance and reconnaissance, mine hunting, interdiction of enemy ships, and the transportation of personnel. The philosophy of the Littoral Combat Ship (LCS) is centered on the concept of a reconfigurable platform that will be utilized to counter anti-access littoral threats. In order to meet the various mission requirements of the LCS, electronic communications equipment tailored for a particular mission will be installed on the ship. This presents a problem for interfacing to the various antennas mounted on the ship. The real estate on the ship is limited, and it is not possible to mount every antenna that is required for each possible frequency range and application. It is, therefore, necessary to develop an antenna system that makes use of fewer antennas. Additionally, an electronics interface which can be rapidly reconfigured for a specific mission is required. The objective of Phase 2 of this project was to focus on the development of key technologies that will lead to significant reduction in cost and the number of antennas needed to support LCS mission requirements.

Payoff

This project developed key technologies that will lead to a 4:1 reduction in the number of VHF/UHF communication antennas needed, with minimal or no performance degradation. A proof-of-concept Antenna Combining prototype was developed and tested. The cost savings associated with this technology includes equipment costs (reduced antennas, RF Cabling, RF Power Amplifiers, and RF Switching) and labor savings (ship's cable pulling, terminating, and testing). Estimated cost savings achieved by integration of the flexible antenna system was approximately $660K per ship. Implementation of the system would reduce the antenna farm from 26 to as few as 5 antennas.

With this technology, the ship will be capable of accommodating new mission package, VHF/UHF communications requirements without the costly process of having to redesign the ship's topside, because no new antennas would be needed. Reducing the antenna count will decrease the maintenance burden of the LCS communications system. A topside weight reduction will also be achieved as fewer antennas will be mounted on the antenna mast.

Implementation

LCS Flight 0+, which includes up to 15 ships that will be awarded annually from 2010 to 2014, has been identified as the primary insertion target for this technology. This Antenna Combining system has been targeted for integration on the ships awarded in FY12 and beyond. This project yielded a demonstrator comprised of an electrical prototype of the desired hardware that exhibited near form-fit factor of the desired final design. Other programs with flexible communications needs could also benefit from the techniques developed in this effort.

Improved Waterjet Inlet Manufacturing Technology to Reduce Production Cost

S2279 — Waterjet Inlet Tunnel (WjIT) Manufacturing Improvement

Objective

The waterjet inlets on the Freedom Class Littoral Combat Ship (LCS) have very specific geometry and smoothness requirements. Legacy shipbuilding practices available to LCS shipyards are not well suited to producing the intake details to the level required. In addition, the intakes are costly to produce in terms of labor and schedule. This project developed an improved solution for waterjet inlet manufacturing and provided the necessary development, testing, and evaluation of several promising manufacturing / technology concepts. A major focus of the production was the development of a near net-shape cast tunnel entry edge to reduce labor needed for fit-up, with improved accessibility for welding and inspection. The newly designed entry edge, which meets specified geometry and smoothness requirements, was also lighter than the legacy design.

Payoff

This project developed manufacturing solutions that were approved by the American Bureau of Shipping and have reduced both the production cost and shipyard duration for construction of the Lockheed Martin LCS. (Exact values are proprietary to Lockheed Martin.) This project has provided several major improvements to the LCS Program. It removed 75 percent of the production hours from the legacy design through implementation of the cast entry edge solution. This project also eliminated 40 weld joints per hull. The cast entry edge solution eliminates more than 30% of the weight of the legacy entry edge.

Implementation

Marinette Marine Corporation and Lockheed Martin have implemented the cast entry edge solution earlier than planned; shipyard implementation was completed in FY10 on LCS-3.

PERIOD OF PERFORMANCE:
March 2009 to December 2010

PLATFORM:
LCS

AFFORDABILITY FOCUS AREA:
Metals Processing and Fabrication

CENTER OF EXCELLENCE:
NMC

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STAKEHOLDER:
PMS 501

TOTAL MANTECH INVESTMENT:
$1,147,000

Cost Savings and Reduced Maintenance to Result with New High Thermal Performance Electronics Enclosures

PERIOD OF PERFORMANCE:
September 2009 to April 2012

PLATFORM:
LCS

AFFORDABILITY FOCUS AREA:
Welding and Joining

CENTER OF EXCELLENCE:
NJC

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PMS 501

TOTAL MANTECH INVESTMENT:
$1,445,000

S2292 — Joining Development for High Thermal Performance Electronics Enclosure

Objective

Modern naval targeting and control systems such as those for Phalanx and SeaRAM Close-in Weapon System (CIWS) require high performance electronic enclosures that handle the high heat loads associated with newly developed microprocessors. Current designs of electronic enclosure cooling systems are sensitive to corrosion and require special fluids, as well as special treatment, performance monitoring, and continual maintenance. There is a need for an ultra high-performance liquid-cooled electronics system enclosure for the next generation Phalanx and SeaRAM systems that solves the corrosion problems of the current design, reduces life-cycle costs, increases system reliability, and maintains superior thermal performance. The objective of this project is to select materials and identify manufacturing techniques for joining these materials to provide lightweight, highly-conductive heat exchanger components that support an improved liquid-cooled electronics enclosure design.

Payoff

Phalanx and SeaRAM CIWS systems are employed on the DDG 51, DDG 1000, FFG, LCS, and other ship classes. Project benefits include life-cycle cost savings due to a reduced footprint for the total system, reduced maintenance, and increased system reliability while maintaining superior thermal performance. These benefits will result from the manufacture of new systems as well as the overhaul and upgrades of current systems. Manufacturing cost avoidance achieved by reduced system size, weight, and part count will result in savings of $200K per electronic enclosure system overhaul, or more than $40M over seven years. Life-cycle cost avoidance due to reduced maintenance and increased system reliability is estimated to generate $2M in savings over 10 years.

Implementation

Raytheon and IWS 3B will transition the results of this ManTech project to the Phalanx and SeaRAM CIWS by integrating the newly developed liquid-cooled enclosure with the current signal processor electronics. The electronics will be the Block 1B Baseline 2 Radar Upgrade System with newly designed, conduction-cooled, quad processor circuit card assemblies (CCAs). These systems are expected to be implemented on current U.S. Navy surface ships such as LCS and DDG 1000 in 2015.

Development of Cryostat Manufacturing Technology That will Meet Navy Needs

S2304 — Development of Long-length, Flexible, Vacuum-Jacketed Cryostats

Objective

For High Temperature Superconducting Degaussing (HTSDG) coil systems, the cryostat (a double-walled vessel used in conjunction with extremely effective thermal insulation with a high vacuum) provides the necessary insulation to maintain a very low resistance condition in the cable. The Navy intends to use HTSDG coil systems on future Navy platforms. The applications require long lengths of cryostats to provide the necessary insulation. Currently no U.S. supplier is capable of manufacturing flexible cryostats that meet application requirements. With the adoption of HTSDG coil systems for the Littoral Combat System (LCS) and other future Navy platforms, orders of cryostats for HTSDG will be over 7,000 meters annually.

This Navy Metalworking Center (NMC) project is addressing cryostat configuration and manufacturing issues associated with fabricating long lengths of flexible, vacuum-jacketed cryostats that meet Navy shipboard performance requirements. Other items being evaluated include reliability performance, fabrication techniques, and the design life cycle of the cryostat for naval platforms

Payoff

Using a domestic supplier for the HTSDG cable systems would result in an anticipated 30 percent cost savings, as well as diminished labor costs and installation duration due to a reduction in the number of cables to be pulled. The HTSDG cable systems would also reduce the overall degaussing system weight by an estimated 50 percent for most ship classes due to the reduced number of cables.

Implementation

The project results will not be implemented at this time because industry participant Southwire was unable to commit the capital investment required to upgrade its manufacturing facility and support a domestic supplier. However, technical tasking to date has identified and provided preliminary confirmation of a manufacturing process that will meet Navy HTSDG requirements.

PERIOD OF PERFORMANCE:
October 2009 to December 2011

PLATFORM:
LCS

AFFORDABILITY FOCUS AREA:
Metals Processing and Fabrication

CENTER OF EXCELLENCE:
NMC

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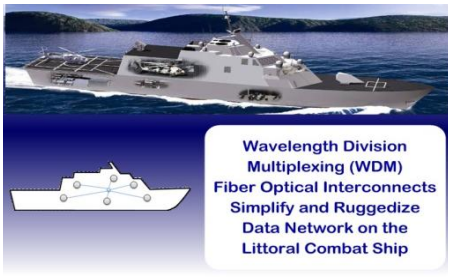
STAKEHOLDER:
PMS 501

TOTAL MANTECH INVESTMENT:
$1,177,000

Cable Fiber Optics to Provide Significant Cost Reduction and a Tenfold Increase in Bandwidth



PERIOD OF PERFORMANCE:
May 2010 to May 2012

PLATFORM:
LCS

AFFORDABILITY FOCUS AREA:
Electronics Processing and Fabrication

CENTER OF EXCELLENCE:
EOC

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STAKEHOLDER:
PMS 501

TOTAL MANTECH INVESTMENT:
$1,640,000

S2305 — LCS WDM Optical Interconnect

Objective

The Littoral Combat Ship (LCS) mission system has thousands of cables connecting mission systems core spaces. The objective of this project is to reduce the number of cables by utilizing optical Wavelength Division Multiplexing (WDM) technology to multiplex approximately 200 Ethernet cable connections onto 37 WDM single mode optical fiber cables.

Implementing WDM technology in optical fiber will result in a significant reduction in cost and weight, simplified cabling, and improved electro-magnetic interference (EMI) immunity. WDM technology will also increase the available bandwidth by a factor of 10, and the reduction in the number of cables will improve maintainability and supportability.

This project focuses on the manufacturing challenges associated with the use of single mode optical fiber interconnections ranging from device levels to cabinet levels as well as the use of WDM to accommodate several types of Ethernet traffic over the same optical fiber. In addition, a manufacturing process will be developed with Navy ManTech's Electronics Manufacturing Productivity Facility (EMPF) that will enable mounting of all electrical and optical components on printed circuit board assemblies. WDM concentrators, which provide multiple Ethernet ports in rack units, will be designed and tested. Fiber optic interconnect systems will be optimized for life-cycle cost and to provide consistent, stable loss for any combination of source / destination.

Payoff

This Implementation of the technology developed in this project is projected to yield a $1.78 M per shipset cost savings and a 10X increase in available network bandwidth. The cost savings will result from a reduced number of cables and installation costs requirements at the shipyard.

Implementation

The project implementation will culminate in generation of an Engineering Change Proposal (ECP) and coordination of the proposal with the Program-Level Change Control Board (PCCB). Implementation is planned for LCS hull number 10, estimated to occur in FY12 at the shipyard.

Best Practices for Shipyard Electronic Document Management System Identified

B2332 — IT Solution for Welding, Standards, Procedures and Documentation Benchmarking

Objective

The Navy's requirements for recordkeeping are extensive. Welding and painting records must be kept for a wide range of procedures including worker training, fit up, welds, inspection, surface preparation, etc. Traditional recordkeeping is time-consuming, expensive, and prone to errors. Commercial data collection systems exist that can reduce or eliminate the need to keep paper records. These systems also help to reduce errors in recordkeeping as well as freeing up office space to utilize for needs other than storage. The objectives of this Benchmarking and Best Practices Center of Excellence (B2PCOE) effort was to survey the current shipbuilding and other industries to see how they handle similar documentation and to identify a best practice for an electronic documentation management system for welding, painting, and maintenance records for the Navy and its shipbuilders. The targeted platform for this effort was the Littoral Combat Ship (LCS) and the demonstration site Marinette Marine.

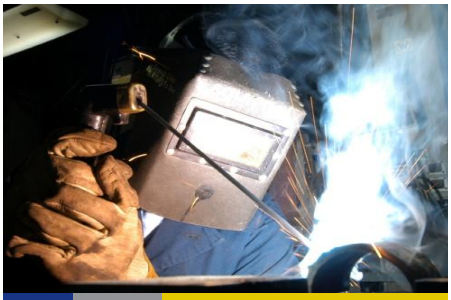
Payoff

There are a number of improvements expected from the use of a document management system. The potential for reduced costs due to elimination of time and effort associated with keeping paper records is one improvement. Improving the accuracy of the records and improve the data collection process by removing ambiguity and standardizing inputs is another. Streamlining the approval process for procedures and eliminating problems with authentication and operator identity as well as the automation of data collection and procedure tracking for Navy and other outside auditing agencies are expected improvements as well. There are also hidden costs, such as off-site storage expenses, on-site space usage, filing supplies, and document distribution expenses including overnight shipping and the cost for replacing lost or misplaced documents that will be improved from the use of a document management system. The benefit to this effort is both in accuracy improvement associated with weld documentation and in overall cost savings associated with document management. A $375K/hull cost savings is estimated on the LCS.

Implementation

The B2PCOE along with other contactors and government agencies will work together to develop and integrate a set of best practices for the development and implementation of a document management system for the Marinette Marine shipyard. At the conclusion of the project, these best practices will be made available to all customers through the B2PCOE after project completion. The dissemination process will include training sessions and implementation of the best practices throughout the defense industry, their suppliers, and the government depot and sustainment centers as needed.

The software has been demonstrated at the Marinette Marine shipyard, and, after demonstration, Marinette is expected to purchase a system in early 2012. The final results of this project will be presented at industry events as well as disseminated on the B2P Web site.



PERIOD OF PERFORMANCE:
March 2010 to October 2011

PLATFORM:
LCS

AFFORDABILITY FOCUS AREA:
Business Processes

CENTER OF EXCELLENCE:
B2PCOE

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STAKEHOLDER:
PMS 501

TOTAL MANTECH INVESTMENT:
$919,000

Atomic Layer Deposition Coating Processes to Result in Significant Cost Savings for Navy Systems

PERIOD OF PERFORMANCE:
March 2010 to May 2012

PLATFORM:
LCS

AFFORDABILITY FOCUS AREA:
Coatings

CENTER OF EXCELLENCE:
EMPF

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STAKEHOLDER:
PMS 501
G/ATOR Program Office

TOTAL MANTECH INVESTMENT:
$3,016,000

S2333 — Atomic Layer Deposition Coating Processes

Objective

The U.S. Navy plans to use advanced and integrated electronics in future radar platforms as the means to achieve transformational capability. These plans will include the development of less expensive, more easily applied, more reliable, and more moisture proof conformal coatings for radar electronics. Of particular interest is the Atomic Layer Deposition (ALD) ceramic based coating that has the potential of providing hermeticity to these electronics. Significant savings are expected from avoidance of the heavy, bulky, hermetic ceramic packaging currently used for this application, by coating the Monolithic Microwave Integrated Circuit (MMIC) chips before packaging or by coating the completed electronic assembly using these ALD-based coatings.

The objective of this project is to evaluate cost reduction opportunities in current radar systems. By using ALD conformal coating at either the chip or completed module level (instead of the currently used hermetic ceramic packaging), an immediate reduction in the cost of all electronic hardware having conformal coatings on Navy weapons systems, ships, aircraft, and communications systems can be realized. In addition, the ability of an ALD coating to improve the reliability of silver by preventing electro-migration under bias in the presence of moisture, will allow the replacement of gold metallization with silver, resulting in a 25-30% transmit/receive (T/R) module packaging cost reduction.

Payoff

This project will result in cost reductions for two systems: the U.S. Marine Corps Ground/Air Task Oriented Radar (G/ATOR) and the Air and Missile Defense Radar (AMDR) for DDG 51. Combining ALD coatings with the plastic packaging technology being developed under Navy ManTech project S2317 (Next Generation VSR Solid State LRU) is expected to lead to $6M savings per hull.

The G/ATOR T/R module is currently packaged using low temperature co-fired ceramic (LTCC) with gold conductors, whose cost is continuing to rise. An ALD coating will provide an additional environmental barrier and potentially enable the use of non-hermetic modules for significant cost reduction. Implementing LTCC with plated silver and ALD coating is expected to enable substantial cost savings for each G/ATOR module. The resulting cost reduction is estimated to be $500 per module, or nearly $400K in a full G/ATOR system.

Implementation

The ALD Conformal Coatings effort will develop the ALD processes and qualification methods for use in low cost plastic packaging and substrate technology for operation in a military environment. At project end, the T/R module performance will have been validated through testing. Follow-on efforts will then incorporate these reduced cost T/R modules into the AMDR system for test and qualification on the DDG 51.

This project is also developing manufacturing processes that can result in a low cost T/R module for the front end of the U.S. Marine Corps G/ATOR system. The program will demonstrate that lower cost silver metallization can replace high cost gold, and assure component hermeticity and stable performance through the application of ALD conformal coatings in LTCC packages, and High Temperature Cofired Ceramic (HTCC) packages. A follow on Transition Program to integrate these processes into G/ATOR designs is planned provided a T/R Module ready for Low Rate Initial Production (LRIP) is currently slated to start in early 2012.

Fiber Optic Network Reduces LCS Cable Number, Weight, and Cost

S2334 — Manufacturing of PCBs for WDM Electro-Optical Assemblies

Objective

The Littoral Combat Ship (LCS) mission system has approximately 1000 cables that are used to interconnect the mission systems core spaces. These cables provide a number of challenges to the LCS and the associated crew including weight and maintainability. The objective of this project is to reduce the number of cables and to develop the manufacturing technologies and infrastructure sufficient to design, build, and test a Wavelength Division Multiplexing (WDM) optical network suitable for use on the LCS.

The critical elements of the WDM concentrator are leveraged from the telecommunications industry where the use of WDM optical interconnects is expansive. The unique aspect of this proposed effort will be to assemble them in a form and function that satisfies the LCS Program requirements. This project will culminate in a proven technology providing both cost and performance benefits that can directly transition onto the LCS and provide an off-the-shelf (OTS) path to future technology insertions.

Payoff

This effort is expected to result in a cost savings $1.78M per LCS hull. The number and length of Ethernet cables will be reduced by 85% (and their corresponding weight by 75%). The reduction in cables will also improve cable installation, maintainability, and supportability. Electro-magnetic interference (EMI) will also be reduced since fiber optic cables do not emit and are not susceptible to EMI. WDM technology will increase the available bandwidth greater than a factor of 100, allowing increased data without the need of additional cables. Reduced manufacturing time and increased reliability of electro-optical assemblies has also been achieved through automating best practices.

Implementation

The strategy for implementing the WDM manufacturing technology into the LCS Program is to work closely with the PMS 501 Program Office. There are three key events for inserting WDM technology into the LCS Program: (1) validate the design and build of two prototype concentrators and the optical star coupler network, (2) develop the WDM optical cable data package, and (3) build LCS production WDM concentrators and optical interconnects.

This ManTech project will conclude with the validation of the WDM concentrator. The development of the WDM optical cable package and the LCS production build will take place in a separately funded follow-on effort. This includes following the established Engineering Change Form process that identifies costs and impacts to other Integrated Product Teams (IPTs). After various levels of reviews and approvals, the final approval is by the Program-level Change Control Board (PCCB). With the completion of both the Manufacturing of PCBs and the WDM Electro-Optical Assemblies, the WDM technology is aligned for insertion into LCS FY2012 Ship 1.

PERIOD OF PERFORMANCE:
March 2010 to March 2012

PLATFORM:
LCS

AFFORDABILITY FOCUS AREA:
Electronics Processing and Fabrication

CENTER OF EXCELLENCE:
EMPF

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STAKEHOLDER:
PMS 501

TOTAL MANTECH INVESTMENT:
$1,559,000

Titanium Alloy Solution Reduces Weight While Decreasing Cost for LCS

PERIOD OF PERFORMANCE:
June 2010 to December 2011

PLATFORM:
LCS

AFFORDABILITY FOCUS AREA:
Metals Processing and Fabrication

CENTER OF EXCELLENCE:
NMC

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STAKEHOLDER:
PMS 501

TOTAL MANTECH INVESTMENT:
$1,354,000

S2341 — Reduced Cost Lightweight Uptakes for LCS

Objective

The initial Littoral Combat Ship (LCS) sea trials showed that the ship weight must be reduced on the ensuing builds to meet performance objectives. One potential area for achieving weight reduction is the high-temperature exhaust ducting for the gas turbine engines, the uptakes. The uptakes are currently comprised of an INCONEL® Alloy 625 interior wall that is exposed to an exhaust temperature of 840°F, a layer of thermal insulation, and a stainless steel exterior that reaches a maximum temperature of 550°F.

The primary objective of this ManTech project is to utilize titanium alloys to reduce the weight of the gas turbine uptake exhaust, while employing high-speed, hot-wire gas tungsten arc welding (GTAW) and a more simplistic configuration approach to reduce part count, tooling and labor cost.

Payoff

A titanium alloy solution whereby the uptake is redesigned to reduce cost and weight is projected to save 22,000 pounds of structural weight on LCS. The reduced weight will benefit the warfighter by enabling faster ship speeds and enhanced flexibility in changing out mission modules. While titanium alloys are beneficial in terms of improved weight, performance, and corrosion resistance, the use of titanium can be costly based on material price and fabrication cost. To offset the cost of implementing titanium alloys, high-speed, hot-wire GTAW will be used to decrease welding fabrication time, and a more simplistic configuration will be employed to reduce part count and labor cost, with a cost reduction goal of 29 percent. Once implemented, the well-proven corrosion resistance of titanium alloys should enable life-cycle cost savings as well.

Implementation

During the course of the project, an uptake section will be manufactured and delivered to Naval Surface Warfare Center, Philadelphia for a test stand trial using a gas turbine engine. Following this trial, the section will be fastened to an existing uptake structure and subjected to a one-year sea trial where a majority of the operational profiles will be carried out. The uptake will be inspected at selected time intervals, and assuming that no damage is observed, the titanium uptake will be fully implemented and utilized on LCS 5 in the third quarter of FY13 and for subsequent LCS builds.

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Low Cost Open Architecture Radar Meets Navy's Upgradable Systems Requirement

S2410 — Low Cost Open Architecture Radar (LCOR)

Objective

The current Littoral Combat Ship (LCS) radar system solutions have posed various challenges to the U.S. Navy. Both Lockheed Martin (LM) and General Dynamics (GD) currently use foreign-built Air Search Radars (ASR) Current solutions do not provide the technical data the Navy requires for performance and radar system modeling, vital for a new surface combatant platform. Also, these current systems have not met the desired affordability objectives.

The initial intent of the Low Cost Open Architecture Radar (LCOR) ManTech project is to develop an open-architecture radar that would meet the Navy's current LCS requirement for a low cost, upgradeable system. Due to an unacceptably high risk of not making the required transition deadline, the effort was re-directed to make use of commercial off-the-shelf (COTS) non-developmental radar that met all of the mission needs of the LCS, and was already in production. The objective of this ManTech effort is to provide PMS 501 with a demonstrated radar architecture that meets the form, fit, function, and requirements of the LCS.

An open architecture validation and test system will be developed to model and simulate the radar and various interfaces. The open architecture with COTS and ITT/Thales designed Line Replaceable Units (LRU) subsystems are to be modeled within a system simulation that ensures future upgrades and technology refresh. In addition, the architecture will enable the participation of other providers of radars and subsystems. This data package will define the hardware and software form, fit, function, specifications, interfaces, and operational parameters of the SMART-S Mk 2 Radar System, and will be the basis for the start of the Transfer of Knowledge and Technology (TOKAT) effort between ITT and Thales.

Payoff

This project will reduce the cost of the current LCS radar system by approximately 20% and fit into the existing radar's topside and below decks available footprint. The open architecture configuration will allow upgrades for new technologies over the lifetime of the project as well as offer lower cost via open competition for the radar's building blocks. The manufacturing results of this open architecture, reduced cost radar effort will be integrated back to the Army's EQ-36 for associated impact and cost savings. Risk will be reduced by making use of a proven COTS non-developmental radar that has already been proven to integrate with both LCS combat systems.

Implementation

The ManTech transition event will occur at the completion of the string test, in July of 2013, to verify LCS requirements. At this point, PMS 501 will make a decision as to what radar system to specify for the September 2013 FY14 LCS Multi-ship Procurement. Upon receipt of a production contract, the production of the SMART-S Radar systems will be transitioned from the Thales Netherlands facility to the ITT Van Nuys facility. As part of this ManTech project, production transition will have already been facilitated by personnel from ACIT and ITT witnessing and assisting in the production of LRUs at Thales and ITT. Implementation is expected to occur on LCS Ship 5 in 2014 at Lockheed Martin and Marinette Marine.

PERIOD OF PERFORMANCE:
March 2011 to December 2013

PLATFORM:
LCS

AFFORDABILITY FOCUS AREA:
Electronic Processing and Fabrication

CENTER OF EXCELLENCE:
EMPF

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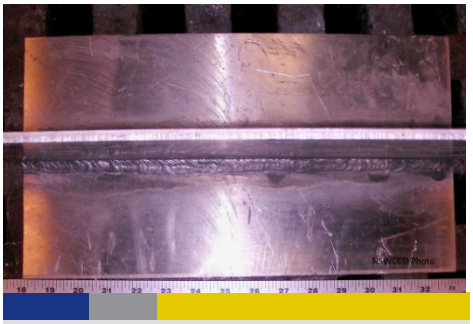
STAKEHOLDER:
PMS 501

TOTAL MANTECH INVESTMENT:
$9,000,000

Relaxing Time Constraints Between Cleaning and Welding of Aluminum Joints Will Save Shipbuilding Costs



PERIOD OF PERFORMANCE:
March 2011 to November 2011

PLATFORM:
LCS

AFFORDABILITY FOCUS AREA:
Welding and Joining

CENTER OF EXCELLENCE:
NMC

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STAKEHOLDER:
PMS 501

TOTAL MANTECH INVESTMENT:
$153,000

R2445 — Extended Delay Between Cleaning and Welding of Aluminum

Objective

Aluminum welded joints are sensitive to defects if the faying surfaces (i.e., surfaces to be joined) are not cleaned properly prior to welding. These defects include porosity, inclusions, entrapped oxides and other discontinuities that can degrade the mechanical properties of the joint. Usually, a weld joint is prepped, cleaned and tack welded and then left in this condition for some time prior to final welding. There is concern that moisture and shipyard debris may contaminate the joint surfaces during this delay, so Navy procedures call for re-cleaning of the joint prior to final welding. However there is no standard procedure for re-cleaning the tack-welded joints, and the guidance on a delay time limit varies from platform to platform. For example, the current requirement for the LCS 2 Independence Class is to re-clean the joint and adjacent surfaces if it sits longer than 16 hours, but for other platforms this requirement is 8 hours. Furthermore, commercial shipyards contend that cleaning only the exposed surfaces is adequate, and that breaking the tack welds to fully access the faying surfaces is too costly and unnecessary for a sound weld joint. This issue also impacts the LCS 1 Freedom Class, JHSV Class, LHA Class, and future Ship to Shore Connector (SSC) new constructions, as well as Landing Craft, Air Cushion (LCAC) and CG 47 Class repairs.

This project's objectives are to better quantify the effects of the delay time between cleaning and welding on aluminum weldment mechanical properties. The mechanical property test results may provide guidance on aluminum welding procedures across the Fleet. Alternatively, if degraded mechanical properties are found, it may be possible to address those weaknesses in the joint design.

Payoff

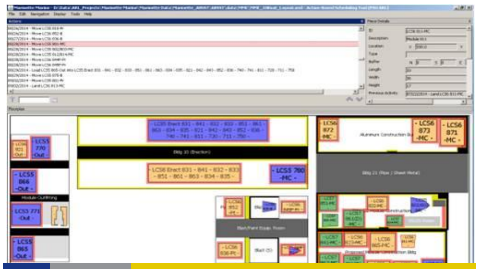
Project results may show that longer delays or simpler cleaning procedures (e.g., not breaking tack welds) may result in acceptable weldment mechanical properties and, thus, lead to significant cost savings. A second cost benefit may result from relaxing the requirement for detailed inspection of joints that are not classified as high stress but are required to be inspected due to noncompliance with current Naval specifications. Another potential benefit is optimization and standardization of aluminum welding requirements across multiple platforms, thereby reducing the administrative cost of maintaining multiple welding guidance documents.

Implementation

Project results will be implemented first on the LCS 2 inspection plan and fabrication of LCS 4 primary hull structure in the first quarter of FY12 at Austal USA. The next platform that may be impacted by these results is JHSV Class; JHSV 2 construction began in late 2010, and JHSV 3 is scheduled for late 2011. LHA class ships are also currently in production.

Tools Developed to Improve LCS Facilities Planning Scheduling

S2456 — LCS Advance Planning and Facility Analysis Toolset



PERIOD OF PERFORMANCE:
July 2011 to March 2013

PLATFORM:
LCS

AFFORDABILITY FOCUS AREA:
Automated Tools

CENTER OF EXCELLENCE:
iMAST

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STAKEHOLDER:
PMS 501

TOTAL MANTECH INVESTMENT:
$350,000

Objective

The Littoral Combat Ship (LCS) design is reconfigurable depending on the current mission. Reconfiguration of the platform to fit a threat / mission allows the base design to serve a variety of missions, reducing overall platform and life cycle cost to the Navy. With the planned production schedule for LCS, Marinette Marine Corporation (MMC) requires expansion and modernization to handle the increased demand making significant investments in facilities and the associated improvements in processes to meet the projected construction demand.

The objective of this project is to develop tools capable of assessing near-term space availability in existing facilities as LCS production ramps up as well as continually plan facility space effectively throughout the LCS acquisition. This will be achieved by investigating MMC legacy planning and scheduling systems to gain a better understanding of how the Activity Based Spatial Scheduling Tool (ABSST), developed under Office of Naval Research (ONR) ManTech funding, can interact directly with live shipyard data. MCC has also indicated an interest in incorporating rules and constraints pertaining to crane / flyover clearance as well as transporter access for module movement. Once proven and accepted by MMC, there will be a full transition and implementation to the module construction, blast and paint, outfitting, and erection facilities.

Finally, the utility of the 3D Erection Visualization Tool (developed under ManTech Project S2167) will be investigated to support LCS construction. The intent of the 3D EVT is to tie lightweight 3D CAD models of ship blocks to a sequence or schedule to visually evaluate the impact of changes to those sequences / schedules. If the spatial scheduling tools are maintained properly (i.e., schedules updated based on planning systems and feedback from shipyard management), the integrated 3D EVT provides a visual status of the erection of the ship from keel laying to launch. Implementation will be determined based on a preliminary investigation to identify the availability of 3D digital models of the erection blocks and feasibility of translation into a suitable EVT format.

Payoff

The use of ABSST will provide the following risk reduction opportunities: (1) the reduction in unplanned overtime to avoid construction delays and meet schedule, (2) the reduction in unplanned outsourcing of manufacturing, and (3) the reduction in unplanned non-value added movement of modules to maintain schedule. MMC anticipates an estimated cost avoidance of $364.3K/hull as a result of successful implementation of this project.

Implementation

The project team will execute this project in five tasks over a period of 21 months. Within each task, MMC stakeholders and software end users will be included and expected to provide feedback to the Institute for Manufacturing and Sustainment Technologies (iMAST) development team as well as the LCS Program Office PMS 501. Transition of the tools will be integrated into the development of the toolset with the tight coupling between the development team and the user groups. Because of the relationship, the new technologies will be transitioned to and implemented at MMC shipyard at appropriate insertion points. Final production implementation will follow established MMC software policies and will occur at scheduled transition events throughout the project duration.

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NAVY MANTECH
Manufacturing Technology Program

VCS / Submarines Projects

Outfitting Process Improvements Reduce Man-hours by 30%

PERIOD OF PERFORMANCE:
June 2007 to January 2011

PLATFORM:
VCS / Submarines

AFFORDABILITY FOCUS AREA:
Outfitting

CENTER OF EXCELLENCE:
CNST and iMAST

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STAKEHOLDER:
PMS 450

TOTAL MANTECH INVESTMENT:
$1,700,000

S2162 — Outfitting Process Improvement

Objective

Reducing VIRGINIA Class submarine (VCS) construction costs to $2B and cycle time to 60 months is key to increasing acquisition and maintaining the submarine industrial base. With the VCS design essentially complete and the bulk of the construction work ahead, one of the greatest opportunities for cost savings and cycle time reduction lie in the outfitting realm, as outfitting activities consume 1.5M man-hours and over 30% of the total VCS manufacturing span time.

The objective of this project was to analyze the major processes employed during the outfitting stage of construction, prioritize the areas targeted for improvement, and recommend improvement solutions. This included analyzing foreman time constraints, current scheduling methods and techniques, as well as understanding the various hand-offs of work, information, and material. Phase 1 project activities analyzed and documented the results for each major process that affects outfitting; Phase 2 developed and implemented process improvements in the appropriate area(s). Implementation results were measured throughout the evaluation to validate assumptions and quantify estimated savings.

Payoff

Of all naval ships, submarines have the tightest, most congested spaces requiring highly engineered arrangements and tighter tolerances for installation. These strict requirements cause outfitting to consume over 30% (1.5M man-hours) of the total manufacturing span time. The process / tool improvements resulting from this effort have already saved $2M per VCS hull, and are expected to grow to approximately $5M per hull when fully implemented. Additionally, because VCS construction activities are shared between General Dynamics Electric Boat (GDEB) and Newport News Shipbuilding (NNS), results from this project have the potential to benefit both yards.

Other expected benefits of this ManTech project include, but are not limited to: increased presence of foremen in outfitting work cells; increased amount of outfitting activities while cylinder / section is in vertical position; earlier layout work for attachments, inserts, cut-outs, and tank marginal plates; reduced amount of manufacturing activities happening in outfitting work cell; and increased efficiency in hand-offs of material, information, and work within and among crews (30K man-hours saved).

Implementation

GDEB implementation of these process / tool improvements began in December 2008. Implementation was executed in a phased approach, with consideration given to the most significant opportunity areas, the length of time required for implementation, and the cost / benefit analysis. As of July 2011, 24 initiatives were fully implemented in support of SSN-784; 13 other initiatives were being implemented. It is expected that the results of this project will reach full implementation during 2012.

Note: This project was led by the Center for Naval Shipbuilding Technology (CNST) with a portion of the work performed by the Institute for Manufacturing and Sustainment Technologies (iMAST).

Improved Production Engineering Management Tools Result in Reduced Construction Time and Cost

S2189-1 — Improved Production Engineering Management Tools

Objective

General Dynamics Electric Boat (GDEB) is committed to compressing the construction span time of a VIRGINIA Class submarine (VCS) hull, thus reducing the unit cost. The objective of this project was to develop a data system and set of tools that integrate high-level planning information with detailed resource requirements. The data system will link with GDEB legacy systems for accurate and 'live' data and information. The tools developed as part of this project will interact with the data system to enable planners, production engineers, and production managers to visualize, analyze, and modify detailed production schedules while also considering resource loading and shop capacities. The users will have the ability to react quickly to high-level planning changes as well as mitigate any schedule or resource aberrations.

Payoff

The data system and toolset developed in this joint project is expected to reduce the overall labor of VCS construction at Quonset Point by 10,500 manhours/year. The breakdown of this 10,500 manhours/year total is 1,500 manhours saved in Steel Processing; 1,500 manhours/year saved in Planning and Production Control; and 7,500 manhours/year saved in Operations. The total of 10,500 manhours saved results in a rough order magnitude cost savings of approximately $683K per hull.

Implementation

To ensure transition and implementation at GDEB, the project team worked closely with stakeholders to ensure that the tools / technologies met their needs and supported the manufacturing processes. The project team adopted an industry standard development technique that gathers input from the end users prior to the development of the software, and the users then provided feedback on the tools through several iterations. Final transition of the tools to GDEB was achieved in August, 2011, and the users were trained on the final software applications. Using this strategy made the transition of the tools an integral part of the development and allowed for implementation at GDEB to begin immediately at the end of the project. Full implementation at GDEB is expected to be completed in January, 2012.

Note: This project is led by the Institute for Manufacturing and Sustainment Technologies (iMAST) with a portion of the work performed by the Center for Naval Shipbuilding Technology (CNST).

PERIOD OF PERFORMANCE:
September 2007 to October 2011

PLATFORM:
VCS / Submarines

AFFORDABILITY FOCUS AREA:
Automated Tools

CENTER OF EXCELLENCE:
iMAST and CNST

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STAKEHOLDER:
PMS 450

TOTAL MANTECH INVESTMENT:
$1,836,000

Process Improves Performance and Reduces Repair Costs for Submarine Propellers

PERIOD OF PERFORMANCE:
April 2007 to December 2010

PLATFORM:
VCS / Submarines

AFFORDABILITY FOCUS AREA:
Metals Processing and Fabrication

CENTER OF EXCELLENCE:
NJC

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STAKEHOLDER:
PMS 450

TOTAL MANTECH INVESTMENT:
$1,113,000

S2196 — Friction Stir Processing of Nickel Aluminum Bronze Propellers

Objective

In-service repair of ship and submarine propellers to restore damage due to corrosion, erosion, and blade deformation is a significant recurring cost to the Navy. The practice was to repair defects and rebuild surfaces by arc welding and then straighten where necessary to restore the correct geometry. The objective of this project was to improve fleet readiness, reduce costs, and improve the cycle time for in-service repair and maintenance of submarine propellers by adapting advanced welding and friction stir processing methods to propellers. Some of the most recent designs make propeller removal extremely difficult, and it is more cost effective to repair these propellers on the vessel. This requires use of gas tungsten arc welding, a process that is not highly productive and not very practical when a large amount of welding is required. Therefore, improved methods were needed that can reduce the time and cost of repairing propellers as well as increase the strength and extend the time between repair cycles.

During this project, friction stir processing (FSP) was combined with an industrial robot to provide a portable method for repair of in-service propellers. FSP parameters were developed and demonstrated on contoured nickel aluminum bronze (NAB) surfaces. A process specification was prepared, working with the Naval Surface Warfare Center, Carderock, and FSP was successfully qualified to this specification on both cast and arc welded NAB materials. Mechanical properties from these tests support Navy adoption of this process. In addition, pulsed gas metal arc welding procedures were developed to permit high-productivity, out-of-position arc welding of those propellers that cannot easily be removed from the vessel.

Payoff

Fiction stir processing can reduce the repair time for surface and subsurface defects in propellers. The process also can strengthen critical areas as well as reduce residual stresses and distortion. Pulsed gas metal arc welding of Virginia Class propellers permits in-situ repair of major defects with a five-fold improvement in productivity compared to current practice.

Implementation

Implementation of FSP for Trident propeller repair did not occur due to a Navy decision to continue using the current repair processes after they were improved. This project does support future implementation of friction stir processing for repair of propellers or other components. The pulsed gas metal arc welding technology was transferred to the Naval Foundry and Propeller Center (NFPC), where welders were trained and the procedures qualified for out-of-position welding Virginia Class propellers.

20% Savings Result from Improved Hull Fabrication and Assembly Welding

S2197 — Improved Hull Fabrication and Assembly Welding

Objective

Continuous improvement in reducing manufacturing costs for VIRGINIA Class submarines (VCS) is a high priority for the Navy and shipyards that build VCS. The overall goal is to reduce construction costs from $2.4B to $2B per hull, as well as to cut construction time from 84 months to 60 months. A key part of this project is reducing ship construction labor costs, including those for welding operations. The Navy Joining Center (NJC), General Dynamics Electric Boat (GDEB), and Huntington Ingalls Industries - Newport News Shipbuilding (HII-NNS) team identified opportunities for application of new manufacturing processes and technologies to reduce the costs of welding hull cylinders and subassemblies. For circumferential hull butt welds, the goal of this project is to reduce welding and assembly labor by 20% through improvements in technology, processes, and procedures. Manual welding and backgouging operations are being replaced by mechanized processes to improve productivity. The objective of this project is to reduce construction costs for VCS by developing and applying technology to reduce welding costs for hull fabrication and assembly

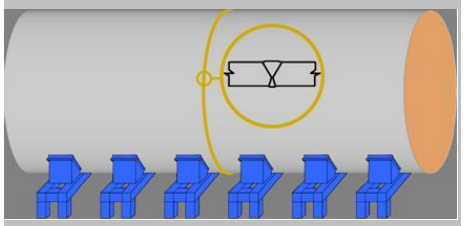
Payoff

To support implementation of the new system at GDEB, a business case analysis was conducted on circumferential hull butt welds that support the use of four mechanized systems for welding and backgouging to be used simultaneously. In February 2009, GDEB estimated savings per hull at $200K. The business case analysis will be updated in July 2012 when the project ends.

Implementation

Current (manual) processes for welding and backgouging were measured to establish the baseline. Functional requirements for the new mechanized welding system were developed. Potential suppliers of welding systems were identified and thoroughly vetted. The project team worked with Servo-Robot to develop and commercialize an improved shipyard welding and backgouging system. Plasma arc backgouging was selected over air carbon arc backgouging due to its superior deep groove capability. Given the current project schedule, the first ship impacted by implemented project results will likely be SSN 788. This project supports construction of VCS and the cost reduction goals of GDEB.

Shipyard evaluations began in October 2010, using the welding/backgouging system purchased by Navy ManTech. Welding trials were conducted on a 5-ft. long section of hull butt joint on the SSN 783. The finished section of mechanized weld passed ultrasonic inspection with zero defects. The next shipyard evaluation was conducted in August 2011 on one full quadrant of a hull butt joint on the SSN 784. Full implementation is expected to occur at GDEB's Quonset Point facility approximately one year after project conclusion in July 2012. In the interim, GDEB will use the Navy ManTech system to weld production hulls until they procure their own welding/backgouging systems.



PERIOD OF PERFORMANCE:
November 2007 to July 2012

PLATFORM:
VCS / Submarines

AFFORDABILITY FOCUS AREA:
Welding and Joining

CENTER OF EXCELLENCE:
NJC

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STAKEHOLDER:
PMS 450

TOTAL MANTECH INVESTMENT:
$1,102,000

Welding Improvements to Reduce Costs by 20% for Structural Fabrications

PERIOD OF PERFORMANCE:
November 2007 to July 2012

PLATFORM:
VCS / Submarines

AFFORDABILITY FOCUS AREA:
Welding and Joining

CENTER OF EXCELLENCE:
NJC

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STAKEHOLDER:
PMS 450

TOTAL MANTECH INVESTMENT:
$1,558,000

S2199 — Structural Fabrication Welding Improvement

Objective

General Dynamics Electric Boat (GDEB) and the Navy are committed to reducing the cost and construction time for VIRGINIA Class submarines (VCS). The overall cost reduction goal is to cut construction costs from $2.4B to $2B per hull. Part of achieving this goal involves reducing construction time for a single submarine from 84 months to 60 months. A key part of this project addresses reducing ship construction labor costs, including welding operations. The Navy Joining Center (NJC) is supporting GDEB in this project to reduce the time and cost of internal structural welding operations. The goal is to reduce welding and assembly labor by 20% through improvements in technology, processes, and procedures. Manual welding and backgouging operations are being replaced by mechanized processes to improve productivity.

Payoff

To support implementation of the new welding / backgouging system at GDEB, a business case analysis was conducted on the specific bulkhead application, which supports the use of six mechanized systems. Projected payoff will be revised at the end of fiscal year 2012. The business cost analysis from the Phase I report (October 2008) estimates the cost savings per ship to be $75K. The business case analysis will be updated in July 2012 when the project ends.

Implementation

This project supports construction of VCS and the cost reduction goals of GDEB. Results of the risk analysis and business case analysis will provide justification for GDEB commitments to implement the results of the project. For a bulkhead application, current manual welding and backgouging processes were measured to establish the baseline. Functional requirements were developed for the mechanized system. Potential suppliers of mechanized welding systems were identified, and the three most promising systems were demonstrated and tested at GDEB. The mechanized solution was selected based on ease of use and acquisition costs. Air carbon arc backgouging was selected over plasma arc backgouging due to easier joint accessibility and superior speed. Given the current schedule, the first whole ship impacted by the implementation of project results will likely be SSN 788.

Shipyard evaluations began in October 2010, using the welding / backgouging system purchased by Navy ManTech. Welding trials were conducted on SSN 785. During a 9-hour shift, welders, using the new system, were able to complete four weld joints and set up the fifth compared to a manual welder who was able to complete only 1.5 welds. Full implementation is expected to occur at GDEB's Quonset Point facility, approximately one year after project conclusion in July 2012. In the interim, GDEB will use the Navy ManTech system to weld production structures until they procure their own welding / backgouging systems.

Improving the Sequencing and Scheduling Aspects of the Outfitting Process

S2241-A-2 — Sequencing and Scheduling (Outfit Process) Phase 2

PERIOD OF PERFORMANCE:
August 2010 to August 2011

PLATFORM:
VCS / Submarines

AFFORDABILITY FOCUS AREA:
Outfitting

CENTER OF EXCELLENCE:
CNST and iMAST

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STAKEHOLDER:
PMS 450

TOTAL MANTECH INVESTMENT:
$770,000

Objective

The objective of this project was to develop and implement the use of an advanced visualization system to improve the sequencing and scheduling aspects of the outfitting process. This tool provided the ability to visualize the assembly and disassembly of submarine components internal to the hull. Through the development of this system, the user is able to quickly and easily analyze where work is being accomplished and ensure that it is being done in correct sequence and as early as possible in the manufacturing and outfitting sequence. This project also determined an optimal sequence for which a given assembly could be built in the outfitting phase, resulting in minimized cycle time. This enabled and resulted in maximized weld mechanization while reducing manual welding. Utilization of an interactive tool enables the planning and outfitting trades to accomplish the following: view the product model of the unit; determine the most optimum method of manufacturing and installation; and conduct pre-requisite planning. These tools provide improved capability for fit-up, welding, sheet metal, electrical, pipe, sound dampening, and outside machine shop detail-planning applications. This project also advanced the development of General Dynamics Electric Boat's (GDEB) One-Stop Software, a tool that extracts geometric data for the VIRGINIA Class submarine (VCS) structure and facilitates the planning process.

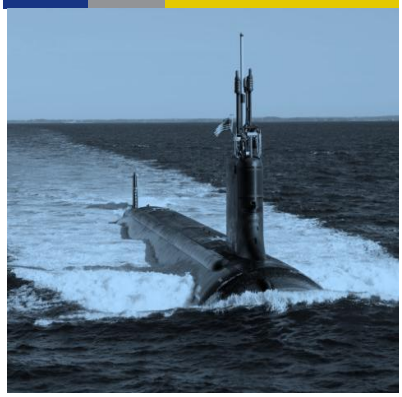
Payoff

The implementation of a manufacturing and outfitting facility with capabilities such as these has been identified as one of the essential components and priorities to significantly reducing the costs of the VCS to $2B per ship. By developing an advanced visualization system to improve the sequencing and scheduling aspects of the outfitting process, GDEB yielded an approximate 15K man-hour labor reduction per VCS hull in addition to significant reductions on manufacturing span times for outfitting. Overall, it is estimated that this project will save an approximately $900K per VCS hull.

Implementation

The efforts put forth in this project facilitated GDEB's commitment to compress the construction span time of a VCS hull from 84 to 60 months. The incremental development of the project resulted in the execution of process improvements and unit re-sequencing as the capabilities became executable. GDEB identified many 'early up" production tasks, moving work from the hull to the shop floor, thus reducing costs and/or span time. Final production implementation will follow when the package is fully tested and deployed. GDEB started the implementation of this technology at its Quonset Point Manufacturing Facility in September 2011 on SSN-786.

Note: This project is led by the Center for Naval Shipbuilding Technology (CNST) with a portion of the work performed by the Institute for Manufacturing and Sustainment Technologies (iMAST).



More Efficient Product Flow in the Pipe Shop

PERIOD OF PERFORMANCE:

August 2010 to September 2011 (CNST)
August 2008 to July 2011 (iMAST)

PLATFORM:

VCS / Submarines

AFFORDABILITY FOCUS AREA:

Facilities and Industrial Processes; Automated Tools

CENTER OF EXCELLENCE:

CNST and iMAST

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STAKEHOLDER:

PMS 450

TOTAL MANTECH INVESTMENT:

$1,155,000

S2242-A-2 — Pipe Shop Process Reengineering (CNST)
S2242-B — VCS Pipe Shop Process Reengineering (iMAST)

Objective

This project identified and classified pipe detail deliverables into specific classes based upon common manufacturing and assembly characteristics. The expressed purpose of this effort was to design and introduce processes that streamline the planning and manufacturing efforts; and, develop manufacturing process lanes and cellular work centers that were specifically designed to be self-sufficient and support a streamlined product flow through shop. Also included in this project was the development of business rules and algorithms for the discrete sequencing of joint-to-joint pipe fitting. The sequential planning for welding of joints traditionally had been accomplished by the trade mechanic as part of his role as a pipe fitter; the goal was to develop business rules and incorporate these rules into the "work instruction download process" where it would then be incorporated into the detail word instructions. As a result of these efforts, span time and all of the associated direct and support costs related to pipe detail and assembly fabrication were drastically reduced.

Payoff

The current pipe shop processes require a significant reengineering effort in order to meet the increased demands of submarine construction: a construction rate of two ships per year, a 60-month performance requirement and significant reduction in man-hours. This effort focused on rethinking the current paradigms and developed processes and introduced manufacturing technologies to transform the pipe shop into a world-class manufacturer of pipe details and assemblies. This project resulted in an estimated 3 man-hour savings for each unique pipe detail fabrication in the General Dynamics Electric Boat (GDEB) pipe shop. With approximately 15K pipe details per VCS hull, there is the potential for $1.2M in cost savings per VCS hull.

Implementation

As improvement plans were defined throughout the project, pilot implementation was conducted to demonstrate re-engineered processes and validate changes. Implementation has been ongoing beginning in December of 2010 following an incremental implementation approach, with efficiencies noted throughout the project's execution. New technologies were fully implemented into EB's Quonset Point Manufacturing Facility processes at appropriate insertion points, with full implementation occurring October 2011 on SSN 786.

Note: This project is led by the Center for Naval Shipbuilding Technology (CNST) with a portion of the work performed by the Institute for Manufacturing and Sustainment Technologies (iMAST).

Development of Corrosion-Resistant Components to Yield $9.4M in Cost Savings

S2263 — Development of 15-5PH Forgings for Torpedo Muzzle Door Lever Arms

Objective

The torpedo tube muzzle door operating linkage for the Los Angeles Class submarine (SSN 688) and subsequent classes of Navy submarines include several critical components produced from K-Monel® (Ni-Cu-Al) forgings. The components do not function as needed in a corrosive seawater environment and must be replaced after eight years of service. This project sought to substitute the K-Monel forgings with modified 15-5PH steel which provides improved mechanical properties and corrosion resistance, negating the need to replace components during the submarine's lifetime. This project developed critical forging and heat treating parameters that will result in material properties tailored for this specific application. 15-5PH steel was evaluated for use on Los Angeles, Ohio, and Seawolf classes of submarines, as well in VIRGINIA Class submarine construction.

Payoff

By eliminating the need to periodically replace these critical components in the in-service fleet, the Navy has estimated the cost savings to be approximately $9.4M over the remaining life of these 70 hulls. Material cost savings will also result from replacing K-Monel with 15-5PH forging s in approximately 292 tube linkage assemblies on 70 submarines representing four different classes. 15-5PH steel offers property improvements over K-Monel, including approximately 20-30 ksi yield strength and improved corrosion performance in this application.

Implementation

Retrofit of existing K-Monel linkage components on the Los Angeles, Ohio, and Seawolf classes of submarines will begin in FY14 after sufficient quantities of machined components are available. The project results were not implemented on VCS at the time of the project's completion.

PERIOD OF PERFORMANCE:
October 2008 to October 2010

PLATFORM:
VCS / Submarines

AFFORDABILITY FOCUS AREA:
Metals Processing and Fabrication

CENTER OF EXCELLENCE:
NMC

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STAKEHOLDER:
PMS 450

TOTAL MANTECH INVESTMENT:
$939,000

Improved Stainless Cladding Procedures Reduce Rework and Increase Weld Quality

PERIOD OF PERFORMANCE:
April 2009 to April 2011

PLATFORM:
VCS / Submarines

AFFORDABILITY FOCUS AREA:
Welding and Joining

CENTER OF EXCELLENCE:
NJC

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STAKEHOLDER:
PMS 450

TOTAL MANTECH INVESTMENT:
$534,000

S2270 — Advanced Robotic GMAW Cladding Process Development

Objective

The Navy Joining Center (NJC) teamed with Babcock & Wilcox Nuclear Operations Group (B&W NOG) to develop controlled dilution high quality stainless steel cladding procedures that meet Navy specifications using commercially available filler materials and power supplies. B&W NOG is the only domestic supplier of large heavy pressure vessels for U.S. Government applications, and has experienced chronic weld quality problems with robotic cladding stainless steel on pressure vessels. Porosity defects can result in more than $300K per year in repair costs. The primary implementation site for this technology was B&W NOG for both VIRGINIA Class submarine (VCS) and CVN 78 Class aircraft carriers.

Payoff

Constant Voltage (CV) cladding procedures were developed that increased contact tip life up to 3× the life of comparable pulsed parameters. The CV procedures also showed a marked improvement regarding porosity reduction, with many CV cladding build-ups exhibiting a 10× reduction in porosity compared to pulsed cladding procedures. Clad quality was examined using radiographic testing with results exceeding NAVSEA technical requirements for soundness. Further research exhibited a correlation between specific chemical elements in the filler wire and the amount of porosity present in completed welds. This discovery indicates that filler metals with refined chemical specifications can be used to achieve porosity reductions in addition to procedural changes. Filler wires that contained sufficient amounts of key chemical elements, namely chromium, exhibited the greatest reduction in porosity when used in conjunction with CV procedures. This project will provide a range of cost savings. The equipment selected will provide the least-cost option for robotic gas metal arc welding (GMAW) equipment investments due to the fact that CV power supplies are thousands of dollars cheaper than pulsed power supplies. Improved contact tip life helps ensure productivity during cladding operations by increasing the total arc-on time. Additionally, minimization of porosity will reduce repair costs by up to $300K per year. Total cost impact will be established in the coming years as B&W implements new cladding power sources, qualifies procedures, and refines their cladding wire metallurgy to minimize porosity defects.

Implementation

Procedures were developed for cladding carbon steel vessels using commercial ER308L and ER309L stainless steel filler metals. Preferred cladding parameters that assure quality and dilution control were developed using a statistical design of experiments methodology. These cladding parameters were further validated on 12-layer build-ups. The equipment selected provided the lowest cost option for robotic GMAW equipment investments. Cladding procedures were transitioned by completing robotic cladding mock-up validations on flat plate mock-ups, providing procedures and chemical element recommendations for procedure qualifications to be conducted by B&W NOG. Transition activities concluded in August 2011 and implementation will be marked by qualification by B&W NOG in late 2011.

Cladding Procedures Decrease Time Required to Refurbish Propulsion Shafts

S2272 — VCS Propulsion Shaft Clad Repair

Objective

The objectives of the VIRGINIA Class submarine (VCS) shaft repair project are to develop laser cladding procedures applicable to both original manufacture and repair and refurbishment of VCS main propulsion shafts. In the repair and refurbishment area, no procedures are currently in place for the refurbishment of the shafts. Laser cladding provides a viable solution for minimizing clad metal dilution and heat input inherent to arc-based processes. Since Pearl Harbor Naval Shipyard (PHNSY) has procured a 4 kW laser system for another project, minimal procurements are required, and the integration of laser cladding into shaft repair leverages this purchase and significantly improves the return on investment for both projects. Specific cost-saving targets for this project include a decrease in the time required to refurbish a shaft (currently two years) and minimize reduction in follow-on straightening and machining operations required for the cladding refurbishment of shafts for the Seawolf class.

Payoff

This project provides both cost savings and cost avoidance goals. Cost savings are primarily obtained through labor savings obtained in the refit, repair, and refurbish tasks performed by the refurbishment vendor or shipyard. Cost avoidance is obtained by removing the need for the procurement of additional spare shafts. Based on a $75/hour labor rate and a steady state rate of 3 shafts per year, the annual labor costs for refurbishment are estimated to be $552K. The cost of a spare shaft is estimated to be $3.7M. By decreasing the span time for shaft refurbishment by 50%, it is assumed that one fewer spare shaft will be required, providing a cost avoidance of $3.7M. The projected cost savings and avoidance of the initial five year period is estimated to be approximately $6.5M when implemented at a single shipyard. The costs will be assumed to double with implementation of the system at two shipyards.

Implementation

The Institute for Manufacturing and Sustainment Technologies (iMAST) is teaming with PHNSY to develop and evaluate laser cladding procedures as an effective and efficient repair for VCS main propulsion shafts. In addition to the development of laser cladding parameters and procedures, iMAST, working with the Naval Undersea Warfare Center - Keyport is designing and integrating a laser cladding system to an existing weld positioner at PHNSY. By eliminating these required movements of the shafts, significant cost and schedule savings can be achieved in the refurbishment of shafts. Implementation of the system at PHNSY is currently planned for June 2012.

PERIOD OF PERFORMANCE:

November 2008 to September 2012

PLATFORM:

VCS / Submarines

AFFORDABILITY FOCUS AREA:

Not Applicable

CENTER OF EXCELLENCE:

iMAST

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STAKEHOLDER:

PMS 450

TOTAL MANTECH INVESTMENT:

$1,006,000

VCS Supply Chain Technology Reviews Evaluate Cost Savings

PERIOD OF PERFORMANCE:

December 2010 to November 2011 EB
October 2010 to February 2012 HII-NN

PLATFORM:

VCS / Submarines

AFFORDABILITY FOCUS AREA:

Business Processes

CENTER OF EXCELLENCE:

CNST

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STAKEHOLDER:

PMS 450

TOTAL MANTECH INVESTMENT:

$ 2,092,000

S2278-EB and HII-NN — VCS Supply Chain Technology Review

Objective

General Dynamics Electric Boat (GDEB) and Newport News Shipbuilding (NNS) are conducting a structured review of the 40 most costly contractor furnished components (CFE) for the VIRGINIA Class submarine (VCS). CFE currently accounts for nearly 30% ($600M) of the cost for a VCS hull, with $146M of that belonging to the 40 most costly CFE items. The GDEB and NNS project teams will thoroughly evaluate each of these 40 components during a series of reviews, encompassing every stage of the installation process, from initial design, procurement, and receipt inspection, all the way through delivery to the ship. Design engineers will determine if current component designs have been optimized to reduce cost and schedule and if the most effective and efficient techniques are being used to manufacture them. Dimensional accuracy requirements that drive costs will be challenged where practical. Design-for-assembly (DFA) tasks affecting components or gaps where DFA should be employed will also be considered. Additionally, the project team will evaluate the vendors' existing infrastructures for their ability to provide components for the soon to be increased two ships per year build rate. Of the initial 40 component vendors, ten will be identified for immediate follow on, where meetings will be held at vendor sites and a clear transition strategy will be developed by both shipyard and vendor to implement changes.

Payoff

GDEB and NNS have set a goal of $1.46M (1% savings of the "Top 40") in CFE costs per VCS hull, based on previous studies and similar supply chain reviews. Considering both ManTech investments into GDEB and NNS efforts, plus implementation costs for both yards, total project investment of approximately $2.1M should be recovered in less than two VCS hulls.

Implementation

The results of this project are to be implemented at the GDEB and NNS. GDEB currently procures 21 of the 40 most costly CFE components, while NNS procures 19. Additionally, GDEB's role as the lead design yard for the VCS Program will require oversight for all 40 components in the areas of component design and engineering. Changes identified for particular vendors will take place at respective vendor sites or within vendors' supply chains. Securing vendor commitment is a key consideration for determining those components selected for Phase 2 follow-on. Implementation could begin in early 2012 based on current project schedules for both shipyards.

Material Flow Processes and Technology Improves Material Issuance and Operations

S2281 — VCS Material Flow Processes and Technology

Objective

In order to meet the increasingly aggressive cost and schedule challenges for the VIRGINIA Class submarine (VCS) program, it is critical to strive for 100% availability and streamlined material flow processes to support on-time trade work execution. To achieve this goal, it is necessary to evaluate the current material flow processes between storage, shops, and construction areas; and within shops using Lean improvement methodologies to identify and execute the top opportunities for cycle time and touch-count reduction associated with material movement. Phase 1 activities, completed in February 2011, included all process mapping, for both current and future states, documentation of areas for improvement, benchmarking studies at several commercial industrial facilities and, a Go / No-Go summary that re-examined the business case and technology payoff for the solutions seemed best suited for implementation. Phase 2 will include the piloting, testing, and evaluation of those technologies or enhancements identified in Phase 1.

Payoff

The labor savings identified for this project are $2.35M labor and $350K material savings per VCS hull.

Implementation

Implementation is expected to utilize a phased approach, where the most beneficial opportunities will be assigned higher priority and implemented first. With 30 of 62 improvement actions items implemented, the VCS's that are currently in production (Groton, Hull 782; Quonset Point, Hulls 783 – 786) are benefiting from this effort. The implementation targeted timeframe is third quarter FY12 at General Dynamics Electric Boat SSN 788.

PERIOD OF PERFORMANCE:
July 2010 to April 2012

PLATFORM:
VCS / Submarines

AFFORDABILITY FOCUS AREA:
Facilities and Industrial Processes

CENTER OF EXCELLENCE:
CNST

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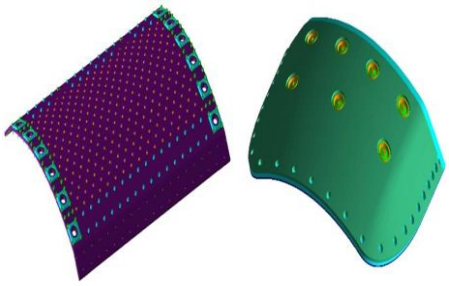
STAKEHOLDER:
PMS 450

TOTAL MANTECH INVESTMENT:
$1,859,000

Automated Machining of Composite Fairings and Array Support Plates to Result in Reduced Cost



PERIOD OF PERFORMANCE:
June 2010 to December 2011

PLATFORM:
VCS / Submarines

AFFORDABILITY FOCUS AREA:
Composites Processing and Fabrication

CENTER OF EXCELLENCE:
CMTC

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STAKEHOLDER:
PMS 450

TOTAL MANTECH INVESTMENT:
$1,346,000

S2285 — Lower Cost Composite Fairings and Array Support Plates (ASPs)

Objective

The current VIRGINIA Class submarine (VCS) Lightweight Wide Aperture Array (LWWAA) composite fairings and array support plates (ASPs) are very large, complex, curved composite structures. The final geometry, tolerances, attachment / mounting holes, and other machined features are currently achieved by hand machining / drilling operations using drill fixtures. Significant labor is required to manually set up the machining hardware and fixtures and perform the machining operations and, as a result, considerable labor costs are expended to ensure the needed degree of accuracy in these parts. Automated machining processes would reduce the required labor and the overall cost of the LWWAA fairings and ASPs fabrication.

The objective of this project is to reduce the current fabrication cost of LWWAA fairings and ASPs by reducing or eliminating the overall labor of manual machining operations by using an automated machining process. Due to the complex curvatures, thickness variations and weights of these LWWAA parts, it is necessary to develop automated machining processes, fixtures, and quality control procedures. This will demonstrate that the automated process can repeatedly achieve the required tolerances while not introducing unmanageable risk to the program. Successful completion of this manufacturing technology effort would address the risks associated with CNC machining, establish cost savings, and ensure that all required performance issues can be met

Payoff

The principal benefit of this project is to lower the acquisition cost for the VCS LWWAA fabrication and installation. The cost savings will primarily be attributable to savings in fabrication labor. Based on current forecasts of production volume for the VIRGINIA Class submarine and assuming the earliest possible implementation, the Return on Investment (ROI) is expected to be up to 4.5.

Implementation

Successful execution of this project will result in an integrated system design that meets PMS 450 and NAVSEA requirements and that will have been validated through testing and analysis and risk mitigation. This will allow the development of composite fairing fabrication techniques that result in a reduced acquisition cost.

General Dynamics Electric Boat and Northrop Grumman Undersea Systems will pursue NAVSEA PMS 450 funding for a LWWAA Fairing and ASP Execution Plan to address all non-manufacturing transition issues and to develop drawing and/or manufacturing specification changes as required to implement and to run concurrent with the ManTech effort. It is anticipated that implementation will occur on Ship Set 14 in late 2011.

Innovative Cableway Foundation Plates and Cableways to Reduce Corrosion

S2286 — VCS Cableway Foundation Plates

Objective

Corroded foundation plates and cableways on the VIRGINIA Class submarine (VCS) require significant maintenance. The objective of this project is to replace the perforated Cableway Foundation Plates and angle bar cableways with innovative composite alternatives which: (1) can be easily integrated into the existing ship structure without significant or expensive alterations; (2) will not rust; (3) will require little maintenance during the 30-year life of the ship; (4) meet all performance requirements; and (5) will reduce total acquisition cost compared with the existing metal designs.

The ability to easily attach and integrate these components the ship structure during construction without impacting cost and schedule will be one of the key criteria.

Payoff

The principal benefit of this project is to eliminate corrosion, reduce life-cycle cost, and potentially lower the acquisition cost for the perforated cableway foundation plates, and angle bar cableways with innovative composite alternatives. The resulting technology will likely be suitable for rapid back-fitting on existing VCS during SRAs (Selected Restricted Availabilities).

Based on a projected Reduced Total Ownership Cost (RTOC) savings forecast of $38M on the VCS sails, and assuming backfits starting at the end of project of six maintenance periods, during the life of the boat over the 30 boat class, the ROI for this effort is expected to be 38:1.

Implementation

As part of the project, perforated cableway foundation plates and angle bar cableways will be inserted on the first available VCS via a TEMPALT (Temporary Alteration) or N-Type ER (Engineering Report) for a one year at-sea evaluation. Then, assuming successful at-sea trial, and acceptance of the technology by PMS 450 and the relevant Navy Technical Codes, the intent would be to have NAVSEA funding in place to accomplish all of the required integration steps for implementation on the VCS via a SHIPALT (Ship Alteration) for delivered submarines, an N-Type ER for submarines under construction, and a D-Type ER for submarines to be constructed. This project is targeting initial demonstration on SSN 783 and implementation on all future hulls and backfits.

PERIOD OF PERFORMANCE:
February 2010 to May 2012

PLATFORM:
VCS / Submarines

AFFORDABILITY FOCUS AREA:
Composites Processing and Fabrication

CENTER OF EXCELLENCE:
CMTC

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STAKEHOLDER:
PMS 450

TOTAL MANTECH INVESTMENT:
$935,000

Automated Fiber Optic Processes to Result in Estimated $65K Cost Reduction per VCS Hull

PERIOD OF PERFORMANCE:
May 2010 to May 2012

PLATFORM:
VCS / Submarines

AFFORDABILITY FOCUS AREA:
Electronics Processing and Fabrication

CENTER OF EXCELLENCE:
EOC

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STAKEHOLDER:
PMS 450

TOTAL MANTECH INVESTMENT:
$239,000

S2294 — Automated Fiber Optic Link Test and Evaluation

Objective

This project will increase affordability of fiber optic deployment in the VIRGINIA Class submarine (VCS) platform through examination of the latest technology and manufacturing methods. The project is expected provide tangible updates to the manufacturing process with associated training.

The objective of this project is to decrease the time required and the cost associated with the successful installation and testing of fiber optic cabling in the VCS during construction. Present methods will be examined and new methods will be evaluated for effectiveness against project metrics.

Payoff

This project will evaluate potential technical improvements in deployment / troubleshooting of the fiber optic infrastructure for reductions in installed cost through increased yield and decreased test time. It is estimated that a 50% reduction in test labor - a saving of 1,080 hours per hull, will occur as a result of this project. The overall cost reduction is estimated at $64.7K per VCS hull.

Implementation

Upon acceptance of the technology by the acquisition Program Office (PO) / Program Executive Officer (PEO), the industrial facility management, and the relevant Navy Technical Codes, the results will be implemented at the General Dynamics Electric Boat (Groton CT) manufacturing facility for the VIRGINIA Class submarine hull SSN 784 Block III, Hull 11.

Photonic Mast Prognostic Health Maintenance to Reduce Cost and Increase Operational Availability

S2302 — Photonics Mast and Periscope FLIR Prognostic Health Maintenance Capability Implementation

Objective

Prognostic Health Maintenance (PHM) is of critical value for VIRGINIA Class and SSGN Class submarine imaging applications. It can be used to show the current health of a system and alert the user of possible forthcoming failures of components that have an established limited wear-out life.

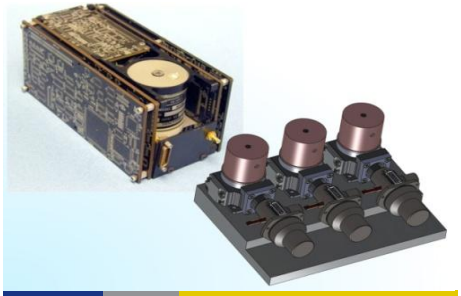
The cooler is a leading driver of forward-looking infrared (FLIR) reliability and has a wear-out mechanism with known lifetimes making it an ideal candidate for PHM. Cooler replacement is costly, time-consuming, and requires photonics mast de-installation, shipping to original equipment manufacturer (OEM), teardown, FLIR removal, and/or cooler replacement at the supplier, FLIR reinstallation, build-up / test, and mast reinstallation. A cooler PHM capability provides a method to monitor cooler health and predict end-of-life in advance of deployments. The objective of this project is to develop and implement Prognostic Health Maintenance Software for the FLIR cryocooler resulting in uninterrupted service life during missions. VIRGINIA Class submarines have two photonics masts each and SSGN Class submarines have one mast each. There will be over 40 photonics masts delivered to the Navy by 2016.

Payoff

The goal of this project is to develop a software algorithm to accurately estimate the FLIR cooler end-of-life and use this information to replace the FLIR cooler during a scheduled mast maintenance event. This will enable both a substantial cost savings and improve the operational availability for the FLIR system as well as the VCS mast by significantly reducing or eliminating the probability of an unscheduled mast maintenance event due to a FLIR cooler failure. Cost savings of $350K per hull in unscheduled maintenance costs are projected for VCS Block IV hulls 19–26.

Implementation

A software upgrade will be provided to implement PHM capabilities into the current rotary cooler NC 640 system. Algorithms will be developed that will provide a predicted cooler life remaining based on the life curves from the life tests and the reported camera information. Similar algorithms will be developed and implemented for the focal plane array (FPA) using existing life data. It is expected that the PHM capabilities will be implemented on VCS Block IV hulls 19 – 26. The implementation date is estimated to be FY14.



PERIOD OF PERFORMANCE:
April 2010 to April 2012

PLATFORM:
VCS / Submarines

AFFORDABILITY FOCUS AREA:
Electronics Processing and Fabrication

CENTER OF EXCELLENCE:
EOC

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STAKEHOLDER:
PMS 450
PMS 435

TOTAL MANTECH INVESTMENT:
$891,000

Reduce Ship Wiring Test Time

PERIOD OF PERFORMANCE:
June 2010 to December 2012

PLATFORM:
VCS / Submarines

AFFORDABILITY FOCUS AREA:
Automated Tools

CENTER OF EXCELLENCE:
EOC

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STAKEHOLDER:
PMS 450

TOTAL MANTECH INVESTMENT:
$1,474,000

S2306 — Integrated Link Testing

Objective

There is a need to reduce the significant amount of labor involved in certification of the harness system used in the VIRGINIA Class submarine (VCS) platform. Manual measurement of thousands of electrical and fiber optic links, required for harness certification, is both time-consuming and error-prone. Uncertainties and omissions in each data record must be corrected before final submission. Typical harness test time per ship is 36,000 hours test time and 3,100 hours engineering time. Typical harness certification records are kept open for four years before they are ready for final certification. Associated with the manual certification process is risk with hook-up errors and data transcription errors. The objective for this project is to significantly reduce the current number of hours (from approximately 36,000) required for VCS harness certification and also reduce risk associated with manual data entry.

Payoff

As mentioned above, there is a need to reduce the significant amount of labor involved in certification of the harness system used in the VCS platform. The benefit of this project is to increase affordability by using automation to increase the efficiency and accuracy of harness test data collection. Project metrics would relate to: (1) efficiency, as certification time per pin, or total harness certification time, (2) reduction of defects and data transcription errors, and (3) return-on-investment measured as system cost versus reduced cost of the above items. In addition, the use of a portable test system linked to a database is expected to reduce deck plate time required for harness test activity. The total projected cost savings for VCS is $468K per hull.

An incentive toward further cost benefit may be realized through further standardization of harness hardware. This reduces fixturing cost by reducing the number of fixtures, and ultimately reduces life-cycle cost by driving a reduction in the number of harness hardware types.

Implementation

First implementation will occur aboard the VCS. However, the general approach will be applicable to harness applications for other ship platforms as well. Once the system is demonstrated on representative hardware, it will be established that the system, in general, will successfully operate in the VCS and other naval platforms. Further implementation (i.e., use of the Integrated Link Test System on other applications and platforms) then will only require specific fixturing for that particular platform.

The event that defines transition for this project will occur when the Integrated Link Test System is introduced into its first application within VCS production. This event will signify that the general system is ready for use in manufacturing systems and for further implementation on other platforms. For VCS, implementation is expected to begin in 2013

Improved VCS Weapons Cradle Manufacturing Results in Cost Reduction

S2319-1-2 — Weapons Cradle Manufacturing Cost Reduction Phases 1 and 2

Objective

VIRGINIA Class (SSN 774) submarine (VCS) weapons cradles are complex assemblies manufactured using extensive welding and machining processes. This complex design must be simplified in order to reduce cost and eliminate unnecessary labor to support the manufacturing rate required by the VCS Program. However, system performance must not be impacted. To improve the producibility of weapons cradles and reduce costs, the Integrated Project Team (IPT) will apply lean manufacturing and design for manufacturing principles to the complex design of the VCS weapons cradle.

Payoff

The target goal for this project is to achieve at least 10% savings per cradle and 5% as the threshold value. Based on a $250K cradle cost, this translates to threshold and target savings goals of $12.5K to $25K, respectively. This project currently anticipates an estimated cost savings of $34K to $67K per cradle or $612K to $1.2M per submarine hull depending on improvements selected for validation in Phase 2. Overall, for a five-year period and 10 hulls, the estimated total cost savings could be $6.1M to $12.0M. Additional savings are planned for improvements implemented prior to SSN 788.

Improvements from the Phase 1 project are also expected to result in component and welding reduction, as well as an improved and repeatable manufacturing process with less rework, fewer engineering waivers and reduced scrap costs while producing better ability for the shipyards to support cradle construction schedules. Build times for the machined cradle weldments are expected to decrease by 30%.

Implementation

Phase 1 has been completed with the end block consolidation, balanced weld joint, and improved dimensional tolerance process improvements transitioned to the Newport News Shipbuilding (NNS) and General Dynamics Electric Boat (GDEB) Process Improvement (PI) system to support implementation beginning with SSN 784. Other improvements such as gusset reduction/standardization, automated welding processes, fixturing, etc., have been identified and are being validated in Phase 2 to support transition and implementation

Phase 2 will validate process and design recommendations and improvements such that the improved design for manufacturing changes can be readily implemented with minimal risk to PMS 450, GDEB, NNS, NAVSEA, and NUWC-Newport. Transitions for the Phase 2 project occur when official PI documentation is submitted to the NNS and GDEB PI system with suitable return on investment values. Implementation may occur as a batch or also as individual improvements to ensure that the benefits are obtained as early as possible. Implementation will occur when NNS and GDEB implement the manufacturing changes into production weapons cradles on SSN 788 in 2013. Some improvements such as the end block consolidation may be implemented as early as SSN 784. A full-scale prototype cradle weldment will be transitioned to PMS 450 upon project completion to support implementation of the collective improvements validated on this project.

PERIOD OF PERFORMANCE:
November 2009 to April 2013

PLATFORM:
VCS / Submarines

AFFORDABILITY FOCUS AREA:
Metals Processing and Fabrication

CENTER OF EXCELLENCE:
NMC

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STAKEHOLDER:
PMS 450

TOTAL MANTECH INVESTMENT:
$4,380,000

Improved Pipe Processing Methods to Result in More Than $500K Savings per VCS Hull

PERIOD OF PERFORMANCE:
March 2010 to November 2011

PLATFORM:
VCS / Submarines

AFFORDABILITY FOCUS AREA:
Metals Processing and Fabrication

CENTER OF EXCELLENCE:
NMC

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STAKEHOLDER:
PMS 450

TOTAL MANTECH INVESTMENT:
$1,080,000

S2326 — Large Diameter Pipe Process Improvements

Objective

Current VIRGINIA (SSN 774) Class submarines (VCS) contain off-hull new construction pipe welding details consisting of complex configurations for large diameter pipe (3"-12" diameters) that require detailed preparation, fixturing, positioning, fit-up, and welding methods. Current fabrication techniques and weld processes require excessive labor in set-up and handling times, reducing work cell process flow output and efficiencies. This Navy Metalworking Center (NMC) project is working to develop improved fixturing and positioning methods, as well as work cell automation techniques that will result in a reduction of 8,500 man-hours per hull. Specifically, the project team is developing several automation methods for specific areas of pipe preparation including fixturing, positioning, and fitting; pipe boss methods; enhanced welding; as well as the use of internal pipe joint blending tools. These improvements will reduce pipe section cutting, rework, and pipe material scrap.

Payoff

Projected savings are currently estimated to be 8,500 man-hours per hull in manual labor. This man-hour savings multiplied by the conservative hourly rate of $65 per hour results in a minimal projected $552K per hull savings and a projected $5.52M savings over the next 10 VCS planned hulls in FY13- FY17 year period. The five-year project ROI is 4.25 based on the projected $5.5M savings relative to the $1.3M in project cost and implementation costs

Implementation

Prototype process improvements were tested and validated in both General Dynamics Electric Boat and Newport News Shipbuilding pipe shops in Q3/Q4 FY2011. Full implementation is expected in both VCS pipe shops for SSN 788 in third quarter FY12.

Improved Blasting Techniques Reduce Shipyard Labor, Material, and Disposal Cost

S2338 — Optimization of Blasting Operations

Objective

Proper surface preparation prior to coating application is critical for coating longevity. Grit blasting is the most common method of surface preparation in shipbuilding, and there are opportunities to make grit blasting and the associated processes more efficient. The Navy Metalworking Center (NMC) project team is conducting a series of trials to optimize the grit blasting parameters. These trials are leveraging the results of previous studies and include various combinations of parameters. These parameters include variations of blast media type, blast media size, nozzle angle, and nozzle type. The project team will ensure that all recommendations comply with surface cleanliness, blast profile, and pipe wall thickness requirements. The project team is also looking at the associated processes of pipe wrapping and unwrapping. Shipyard procedures require that piping systems be protected when blasting nearby surfaces. The current practice is to wrap the piping, blast the surface, remove the wrapping, clean the piping, and rewrap the piping prior to painting.

Payoff

The results of this project are expected to save approximately $350K per hull in reduced labor, materials, and disposal cost. The majority of these savings are the result of reducing the labor associated with wrapping pipes prior to blasting in a tank. Pipe wrapping and removal processes developed by the project team are expected to reduce wrapping and unwrapping labor by 60 percent.

Implementation

Initial implementation is expected to take place at General Dynamics Electric Boat and Newport News Shipbuilding for SSN 787 in 2012. Project results will also apply to almost all ship classes.

PERIOD OF PERFORMANCE:
May 2010 to March 2012

PLATFORM:
VCS / Submarines

AFFORDABILITY FOCUS AREA:
Facilities and Industrial Processes

CENTER OF EXCELLENCE:
NMC

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STAKEHOLDER:
PMS 450

TOTAL MANTECH INVESTMENT:
$610,000

Material Risk Management Tool to Aid in Improving VCS Supply Chain Management

PERIOD OF PERFORMANCE:
March 2010 to March 2011

PLATFORM:
VCS / Submarines

AFFORDABILITY FOCUS AREA:
Business Processes

CENTER OF EXCELLENCE:
B2PCOE

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STAKEHOLDER:
PMS 450

TOTAL MANTECH INVESTMENT:
$228,000

B2342 — Supply Chain Management Benchmarking Study

Objective

The objective of this Benchmarking and Best Practices Center of Excellence (B2PCOE) project was to conduct benchmarking to support General Dynamics Electric Boat's (GDEB's) existing efforts to establish a formal Material Risk Management process to ensure and maintain a viable industrial base for VIRGINIA Class submarines (VCS) by 2QCY11. The goal of this effort was to achieve a 96% on-time delivery value with material meeting required quality attributes in accordance with contractual requirements.

Successful execution of this task included identifying and piloting of a Material Risk Management tool. The benchmarking activities identified Material Risk Management processes and tools likely to support the risk facing GDEB for VCS construction. The activities associated with this effort included developing a benchmarking and implementation plan, creating a Current State ("As Is") Process Map that baselined the existing informal Material Risk Management processes, conducting benchmarking events and associated gap analyses, and identifying best-in-class Material Risk Management practices to support implementation.

Payoff

In addition to cost avoidance, anticipated cost savings was based on the following: (1) the estimated reduction of 500 labor hours per hull in the Service and Support Major Milestone (MM97) based on earlier risk identification and mitigation activities related to supplier viability, on-time material delivery, and material quality to yield $42.5K/hull savings and (2) the estimated reduction of 15 non-conformances per hull (i.e., Engineering Reports (ERs), non-conformance Vendor Information Requests (VIRs), and Supplier Corrective Action Reports (SCARs)) at a cost of $500 per non-conformance to yield $7.5K/hull savings. Together, these benefits represent a cost savings of $50K/hull as verified by GDEB.

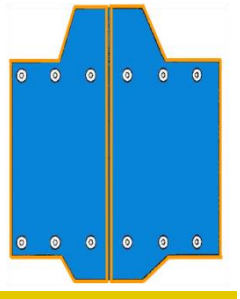
Implementation

GDEB has initiated a VCS Material Risk Management Program to establish a methodology for material risk management. These best practices were made available to all customers through the B2PCOE. The results of this project were implemented in the VCS Material Risk Management Program.

The pilot project concluded in December 2010 and transitioned in 2Q2011. The results were incorporated into the full deployment of SCRA procedures at GDEB.

Composite Sail Cap Covers and Plates to Result in Reduce Cost and Increased Product Fit

S2345 — Net Shape Fabrication of Composite Sail Cap Covers and Doors



Objective

Existing VIRGINIA Class submarine sail cap steel radar mast cover, bridge closure door, towing pendent access cover, lookout closure door, universal modular mast (UMM) closure doors (6), snorkel mast closure, and permanent and removable sail caps are susceptible to general corrosion over the lifetime of the ship resulting in significant maintenance costs. In addition, cost to manufacture the steel covers, doors, and permanent and removable sail caps include touch labor required to rework the "as-fabricated" component to facilitate fit-up in the sail cap. This fit-up is required for every new ship as a result of ship-to-ship variability. The objective of this project is to develop and demonstrate an integrated, innovated low cost net-shape composite cover and plating fabrication technology to: (1) address corrosion, (2) reduce maintenance and acquisition cost and, (3) meet performance requirements.

Payoff

The principal benefit accrues from life cycle cost reduction due to implementation of corrosion-resistant material systems that reduce the amount of maintenance required per scheduled maintenance interval and reduced periodicity of maintenance over the life of the ship. It is also anticipated that acquisition cost reduction will be realized since rework of the "as-fabricated" metal components will not be necessary for net-shape fabricated composites and the counterweight system currently required for metal closure doors may be eliminated. Finally, the lighter weight composite covers and doors provide easier installation and closure by the ship's hydraulics and crew.

The ROI is based on 14 ships remaining in the class, an estimated minimal savings of $750K per hull, for a return on investment of at least 9.1.

Implementation

The composite door cover and removable sail cap will be non-destructively inspected using a calibrated ultrasonic inspection technique. Calibration blocks will be fabricated to facilitate the calibration of the proposed Non Destructive Inspection (NDI) method. Funding for TEMPALT installation and NDI calibration block fabrication will be part of the NAVSEA effort. If successful, full implementation will occur on SSN 790.

PERIOD OF PERFORMANCE:
January 2011 to December 2012

PLATFORM:
VCS / Submarines

AFFORDABILITY FOCUS AREA:
Composite Processing and Fabrication

CENTER OF EXCELLENCE:
CMTC

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STAKEHOLDER:
PMS 450

TOTAL MANTECH INVESTMENT:
$1,150,000

Alternate SHT Inspection Methods to Avoid Costs During VCS Construction

PERIOD OF PERFORMANCE:
October 2010 to February 2012

PLATFORM:
VCS / Submarines

AFFORDABILITY FOCUS AREA:
Outfitting

CENTER OF EXCELLENCE:
NMC

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STAKEHOLDER:
PMS 450

TOTAL MANTECH INVESTMENT:
$499,000

S2363 — SHT Debond Detector

Objective

Special Hull Treatment (SHT) must be sufficiently adhered to the hull to permit longevity of the system and to ensure peak functional performance while in service. Debonding or delamination of the system can degrade both durability and performance. To ensure proper adhesion, quality inspections are completed after installation of the system. The current inspection process consists of manually tapping the SHT using a hammer to identify debonded areas, which is very subjective to the inspector performing the inspection.

This Navy Metalworking project will investigate the use of impulse hammers to increase the accuracy of detecting debonded areas. Use of an impulse hammer mimics the current inspection method; however, the input force and response are measured electronically instead of using human senses. Prototype test equipment will be generated as part of this project. Additional evaluation and possible modifications need to be completed to transfer this technology into the construction process for VIRGINIA Class submarines (VCS).

Payoff

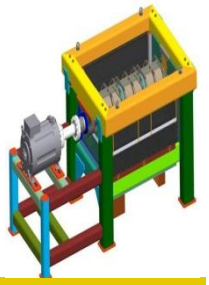
Identifying and correcting a debonded SHT area during VCS construction is significantly less costly than correcting the problem after delivery of the ship. During construction, the processing equipment, staging and environmental controls are already in place. While the labor to correct the problem in dry-dock is similar to that during construction, additional effort is required to set up the equipment and staging area and to establish the proper environment in a dry-dock situation. A cost avoidance of $348K per hull may be realized by repairing SHT debonds during construction as opposed to after delivery.

Implementation

The Office of Naval Research must transfer ownership of the prototype impulse hammer system to the VCS Program Office (PMS 450), which will transfer the prototype equipment to General Dynamics Electric Boat (GDEB) or Newport News Shipbuilding (NNS) in order to make the system available for use. Detailed inspection procedures will need to be generated and used for training of inspection personnel. Construction references must be updated to identify the new inspection technique to be used during installation of the SHT system. Implementation is planned for November 2012 at EB for SSN 786.

Significant Cost Savings and Existing Shafts Lifetime Extension Anticipated

S2368-A-B — Improved Shaft Cladding Materials and Processes



Objective

The inspections of in-service VIRGINIA Class submarines (VCS) main propulsion shafts have revealed noticeable grooving of the electro-slag strip (ESS) cladding on the propulsor bearing journal. NAVSEA is overseeing a series of coordinated efforts to investigate three individual tasks: (1) identifying the root cause and solution to the bearing journal wear; (2) increasing the VCS main propulsion shaft change-out periodicity to 96 months or more; and (3) developing technologies to provide the necessary background knowledge to achieve the goal of a 144-month shaft change-out periodicity for the Ohio Replacement Program (ORP).

The main objective of this ManTech project is to identify appropriate solution(s) to the bearing journal wear observed on the VCS main propulsion shafts that is capable of increasing the current shaft replacement cycle from 72 to no less than 96 months. The project will also develop and provide potential solutions for the mitigation of the grooving wear. In developing these potential solutions, Navy Metalworking Center (NMC) and the Institute for Manufacturing and Sustainment Technologies (iMAST) will combine the knowledge and the data obtained from the on-board instrumentation suite and use it to provide the Navy with realistic alternatives for improving the lifetimes of VCS main propulsion shafts.

Payoff

Cost savings originating from longer shaft operational lifetimes can be realized through two primary mechanisms: the increase in shaft change-out periodicity and the need for fewer spare shafts. The cost of each shaft change-out is calculated at $4M, including the labor and material for the replacement of the shaft itself ($3M) and the refurbishment at the vendor ($1M). Indirect cost savings can be attributable to the avoidance of costs involved in the procurement of additional shafts as the current 72 month change out schedule is increased to 96 months or beyond. Considering the cost of a spare shaft at a value of $3.7M.

Implementation

An Integrated Project Team (IPT) has been formed, consisting of Naval Surface Warfare Center, Carderock Division- Ships Systems Engineering Station (NSWCCD-SSES), Naval Sea Systems Command (NAVSEA), and General Dynamics Electric Boat (GDEB) to oversee shafting programs including this project. Jorgensen Forge and Erie Forge and Steel, Inc., as manufacturers of the main propulsion shaft for VCS will participate to facilitate transition and implementation of project results.

NMC will be primarily responsible for the materials testing and evaluation tasks and iMAST will be responsible for the fluid dynamics modeling and on-board instrumentation suite development tasks.

Success begins when NMC and iMAST provide the Navy IPT with the required information regarding the properties of the journal bearing material and the fluid flow conditions in the bearing and also when the Navy implements a solution to the current bearing wear issue.

Note: This project is a joint COE effort between the Institute for Manufacturing and Sustainment Technologies (iMAST) and the Navy Metalworking Center (NMC).

PERIOD OF PERFORMANCE:

December 2010 to August 2012 (iMAST)
November 2010 to January 2013 (NMC)

PLATFORM:

VCS / Submarines

AFFORDABILITY FOCUS AREA:

Metals Processing and Fabrication

CENTER OF EXCELLENCE:

iMAST and NMC

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STAKEHOLDER:

PMS 450

TOTAL MANTECH INVESTMENT:

$349,000 (iMAST)
$2,574,000 (NMC)

Improved Inspection Technology to Reduce Total Ownership Costs for Submarines

PERIOD OF PERFORMANCE:
February 2011 to December 2013

PLATFORM:
VCS / Submarines

AFFORDABILITY FOCUS AREA:
Coating

CENTER OF EXCELLENCE:
iMAST

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STAKEHOLDER:
PMS 450

TOTAL MANTECH INVESTMENT:
$900,000

S2390-A — Nondestructive Corrosion Detection Under MIP

Objective

The project objective is to develop and demonstrate nondestructive technologies capable of detecting disbonds and corrosion between the Mold-in-Place (MIP) coating and the hull structure to enable quality control of the original fabrication and to reduce labor / time content for maintenance operations. The reduction of total ownership cost (RTOC) and acquisition cost avoidance of initial MIP application will result from the implementation of rapid wide area inspection technologies at the Navy Maintenance Shipyards.

Payoff

Inspection technologies are required to detect and locate the disbonded areas to assess the initial fabrication improvements and long-term adhesion of the MIP coating performance. The primary project benefit will be the development and implementation of an inspection technology with enabling capability of initial evaluation and maintenance cycle assessment of the MIP coating adhesive integrity. The proposed project will significantly reduce labor costs associated with rework and unplanned maintenance. It may also facilitate shorter maintenance times via the accurate location of disbonded areas. General Dynamics Electric Boat (GDEB) has estimated initial acquisition cost savings at $1M/hull with reduced total ownership costs (RTOC) of $855K/hull. Subsequent RTOC, based on reduced shipyard time and labor, suggest a return-on-investment (ROI) at 6.5 over 5 years.

Implementation

Two incremental transition events are planned for this project to allow the shipyard artisans and ship platform personnel enough direct evaluations to determine the successful transition of the proposed technology solution – ultrasound guided waves. The first transition event is at the Applied Research Laboratory (ARL)/Penn State in-house evaluations of potential protocols that meet the shipyard and NAVSEA community initial requirements. This event(s) shall take place at ARL/Penn State with a full evaluation report submitted to the Navy stakeholder and shipyard artisans afterward. A second transition event or events shall take place at a Naval Shipyard (NSY) or naval facility to allow as many navy engineers and artisans as possible to witness, conduct and evaluate the Ultrasonic Guided Wave NDE/NDI inspection technology chosen. Shipyard feedback and data will be requested, evaluated, and incorporated into the new version of the selection process, if applicable. The respective technical assistants at Pearl and Portsmouth NSY have the final disposition decision. The evaluation will be conducted on the shop 64 MIP/SHT mock up at either Portsmouth or Pearl Harbor Naval Shipyard.

Implementation will be through direct technology insertion at NSY maintenance facilities, scheduled for second quarter FY13.

3D Laser Scanning Tool Increases Productivity for Ship Component Installations

R2453 — Measure, Layout, and Install Ship Components Using 3D Laser Scanning Tool

Objective

The objective project will develop a list of solution requirements that need to be identified based on the information on advancement of the 3D laser scanning technology and other requirements applicable to the process. General Dynamics Electric Boat (GDEB) will identify detailed information for each of the requirement areas on the list (i.e., types of scanners, ship components, size of components, time components are in a location, types of access required, time required to capture the as-built xyz measurements, time required to post process the data into 3D model for analysis, etc.). GDEB will gather requirements information and provide a final requirements list for Integrated Project Team (IPT) review. Process metrics will be defined to collect, document, and report for the process using the 3D laser scanning tool and post processing software applications. With IPT input, GDEB will document potential test plans and identify costs impacts (procurement and operational) of each potential test plan. The project team will identify process and hardware selected and prototyped, and provide the implementation plan. GDEB shall provide input on the test results and the process metrics collected using the 3D laser scanning tools during the data collection / analysis, and post processing efforts during the installation of the ship components.

Payoff

A principle benefit of this project is the elimination of expensive targeting and staging requirements for ship component installations. The project has a potential cost savings of $62.4K per hull.

Implementation

The implementation path is in place, as GDEB is targeting system use for fabrication activities as soon as possible. GDEB is anticipating a late spring 2012 trial use for expedient new construction and repair applications have already been identified. GDEB expects to use the metrology system(s) at the GDEB Groton facility and possibly at their Quonset Point site. Implementation is targeted for SSN 786.

PERIOD OF PERFORMANCE:
May 2011 to November 2011

PLATFORM:
VCS / Submarines

AFFORDABILITY FOCUS AREA:
Automated Tools, Facilities and Industrial Processes

CENTER OF EXCELLENCE:
CNST

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STAKEHOLDER:
PMS 450

TOTAL MANTECH INVESTMENT:
$119,000

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NAVY MANTECH
Manufacturing Technology Program

Joint Strike Fighter Projects

Improved Process to Reduce Cost of BMI Fiber Placement for JSF

PERIOD OF PERFORMANCE:
March 2009 to August 2011

PLATFORM:
Joint Strike Fighter

AFFORDABILITY FOCUS AREA:
Composites Processing and Fabrication

CENTER OF EXCELLENCE:
CMTC

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STAKEHOLDER:
PEO (JSF)

TOTAL MANTECH INVESTMENT:
$3,100,000

A2267 — Improved BMI Fiber Placement

Objective

The Joint Strike Fighter (JSF) utilizes carbon bismaleimide (BMI) on many of its large structural parts due to its ability to meet extreme thermal and mechanical demands. . The Automated Fiber Placement (AFP) process was adopted for many of the large wing structural components for affordability reasons. While AFP fabricating is common practice for epoxy composites, it was not optimized for BMI. The JSF program has experienced reduced lay-down efficiencies in Low Rate Initial Production (LRIP) when using AFP with BMI. Productivity challenges are adversely impacting the affordability of the program and if not improved, will require additional machines, facilities, tool sets and labor resulting in significant cost to the JSF program.

The Navy Manufacturing Technology program (Navy ManTech), through the Composites Manufacturing Technology Center (CMTC), assembled a multidisciplinary project team to optimize the AFP processing of carbon BMI materials. The team's objective was to develop and demonstrate Material, Equipment and Process improvements for fiber placed carbon BMI. BMI Material improvements focused on process optimization to improve impregnation levels, adhesion to the part surface and reduce fuzz generation. Machine improvements focused on improving the fiber tow path and material handling; this effort included development of infrared heating technology, development of contoured redirect and tensioning rollers to reduce friction and improvements to address fiber alignment and reduce resin build-up. A series of Designed Experiments was used to optimize process parameters and settings. The results are a three-fold increase in productivity as measured by fiber lay-down rates.

Payoff

The cost savings per aircraft is anticipated to be $50K. Cost savings per aircraft combined with program nonrecurring savings and capital cost avoidance produce an initial estimated financial impact to the DOD of $100M over the life of the JSF Program.

Implementation

Benefits of this project are already being realized on JSF production hardware. The material, machine and process improvements were validated on JSF production equipment and then implemented in the production process. The initial impact is being realized on wing skins and engine nacelle skins. The machine improvements are now standard for all future machines and retrofittable to existing machines. The improved material form is the new standard carbon BMI AFP grade material. The process guidelines have been shared throughout the JSF supply base and industry to benefit additional JSF production and future platforms

Out of Autoclave Composites Eliminate the Need for Autoclave Curing

Z2276 — Out of Autoclave Composite Processing

Objective

The development of the fundamental processing parameters for automated fiber placement (AFP) of Out-of-Autoclave (OOA) composites is a key stepping stone to achieve the cost and performance goals of next generation production aircraft. OOA material systems are an attractive alternative to existing autoclave composites because costs associated with obtaining and operating outsized autoclaves is significantly higher than for equivalent large ovens. This cost difference limits the number of suppliers equipped to fabricate large parts. Developing the ability to fiber place OOA materials provides an enabler for the fabrication of very large single piece composite structures.

The project's objective was to develop fundamental processing parameters for the automated fiber placement of out-of-autoclave composite materials for future aircraft structural applications

Payoff

OOA Large autoclaves require large amounts of capital investment as well as higher operating costs. By replacing autoclaves with traditional ovens, the principle investment drops by a factor of 10 as well as a significant drop in operating cost. OOA materials combined with AFP productivity advantages provide affordable manufacturing alternatives for primary and secondary structures particularly for rapid prototyping of aero structure platforms.

Implementation

The technology developed under this project can be applied to numerous large scale composite aircraft applications. Potential applications include long range strike platforms, next generation transport aircraft, and large ISR platforms. While large scale components like skins and wing spars are clear benefactors of the labor cost savings afforded by OOA FP, the capability and flexibility of FP processing offer material and labor savings on smaller components as well.

This is a joint project with funding from the Navy, DOD and Air Force ManTech programs as well as the Defense Logistics Agency (DLA) and NASA

PERIOD OF PERFORMANCE:

August 2009 to August 2011

PLATFORM:

Joint Strike Fighter

AFFORDABILITY FOCUS AREA:

Composites Processing and Fabrication

CENTER OF EXCELLENCE:

CMTC

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STAKEHOLDER:

PEO (JSF)

TOTAL MANTECH INVESTMENT:

$6,270,000

F-35 Canopy Thermoforming Automation Saves Over $75M

PERIOD OF PERFORMANCE:
December 2010 to December 2012

PLATFORM:
Joint Strike Fighter

AFFORDABILITY FOCUS AREA:
Composites Processing and Fabrication

CENTER OF EXCELLENCE:
CMTC and iMAST

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STAKEHOLDER:
PEO (JSF)

TOTAL MANTECH INVESTMENT:
$1,377,000

A2346-A-B — F-35 Canopy Forming Thermoforming Automation

Objective

F-35 and other military aircraft require large, thermoformed stretched acrylic canopies for mission success. The canopies are critical for pilot vision, interface with night vision and helmet mounted sights and low-observable (LO) performance through shape and coating systems. The F-35 Canopy is a significant advancement in size, shape and dimensional tolerances compared to legacy transparencies. The F-35 requires a transparency that will simultaneously satisfy demanding optical requirements, withstand severe bird impact events and provide acceptable LO performance. These design drivers result in a large, single-piece stretched acrylic canopy with an integral laminated windshield section and external coatings. The F-35 canopy is one of the largest thermoformed transparencies in the industry and requires a demanding, high temperature process to meet optics and thickness tolerances.

The objective of this project is to develop an automated method of controlling and monitoring the thermoforming process to: (1) reduce manual intervention, (2) cut thermoforming cycle time by as much as 30%, (3) reduce overall costs by 5-10% and, (4) improve the optical quality of the canopies after forming and increase capacity of existing tools and facilities. Achieving this will result in significant cost savings to the F-35 project over the aircraft life cycle

Payoff

Total savings are estimated at $75M in recurring canopy procurement, $1.4M in non-recurring PNR tooling costs and 30-50% reduction in the forming and clean-up manufacturing cycle times. These improvements are significant, especially as manufacturing capacity has been a concern on legacy canopy and windshield programs in the past.

It should yield a reduction in recurring production costs with a savings to the government of $75M over the life of the aircraft assuming that the transparency and associated systems (frame, severance systems and finishes) achieve the design life of 2,000 flight hours or five years of service. A return on investment (ROI) of 67 is expected; ($75,000,000+$1,400,000)/$1,145,000 = 67.

If the canopy lifetime is three years, then as many as 30,000 canopies would be required over a 30 year aircraft service life. This would provide a $150M savings to the program. A ROI of 132 is expected; ($150,000,000+$1,400,000)/$1,145,000 = 132

Implementation

The technology developed under this ManTech program is expected to be implemented at GKN where production canopies are currently being produced for the F-35. The Technology Transition Plan is currently being reviewed by Lockheed Martin and has initial approvals from all other interested parties. GKN ATS will implement the processes developed in this project to the existing F-35 thermoforming tools and equipment starting in June 2012 in the LRIP 6 time frame.

Development of System-on-Chip RF Tuner Reduces Unit Recurring Flyaway Costs for JSF

A2347 — Joint Strike Fighter System-on-Chip RF Tuner Manufacturing

PERIOD OF PERFORMANCE:
March 2010 to January 2015

PLATFORM:
Joint Strike Fighter

AFFORDABILITY FOCUS AREA:
Electronics Processing and Fabrication

CENTER OF EXCELLENCE:
EMPF

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STAKEHOLDER:
PEO (JSF)

TOTAL MANTECH INVESTMENT:
$3,428,000

Objective

In the continuous drive to improve Unit Recurring Flyaway (URF) costs on the Joint Strike Fighter (JSF), technology advancements are being developed and incorporated into the redesign of existing modules. These changes may be driven by various circumstances such as Diminishing Manufacturing Source (DMS) events, additional required capability enhancements, or straight cost trades. The RF Tuner System-on-a-Chip (SoC) concept consists of a redesign that is driven by DMS and capability demand. A very real benefit of cost savings due to this redesign is also a factor. Manufacturing materials selection and process development for the use of these SoC devices in the extreme military environments are required to ensure the same level of excellence in military applications benefited by standard commercial technology products in today's industry. This ManTech effort entails material evaluation and downselect as well as the development of manufacturing processes that can withstand the military environments, while assuring low cost, repeatable manufacturing of SoC devices.

The primary goal of this project is to identify and develop manufacturing processes and materials that will mature the Manufacturing Readiness Level (MRL) associated with the SoC technology from an MRL 4 to MRL 5. This project will result in a material selection guide and manufacturing process for the assembly of SoC devices that facilitate the developed technology's move up the MRL curve, enabling its implementation into JSF production. The results of this project will also be shared with the DOD industry, enabling a wider use of the cost, power, and capability enhancements offered by SoC technology. This can speed up the adoption of this new technology by other defense equipment producers to magnify the payback on this investment by eliminating costly duplication efforts in maturing processing of SoC-based hardware materials and processes.

Payoff

The Redesign for DMS replacement will cost approximately $11M with no additional capability. Replacement of the DRFM suite with BAE Systems DCR/TG approach will yield added capability as well as weight and Unit Recurring Flyaway savings. A key component to this suite is a Quad Tuner which utilizes SoC technology. Savings are estimated at $410K per shipset (in 2010 dollars).

The F-35 is a joint program between Navy and Air Force. This Navy ManTech investment will continue to mature the manufacturing technology needed to produce the tuners in quantity for the F-35 and other platforms. The ROM estimate to insert the SoC tuner technology into the F-35 AN/ASQ-239 is $25M. For the Navy return-on-investment, the implementation price of $25M is assumed to be split $8.3M and $16.7M between Navy and Air Force respectively.

Implementation

The results of this Navy ManTech project will be implemented as part of a hardware upgrade to the EW system for the JSF. BAE supplies the JSF EW suite to Lockheed Martin. The hardware upgrade is currently planned for cut-in during LRIP-8. Demonstration is planned for fourth quarter 2012. Though the EW Suite for LRIP-8 has not been formally specified, it is expected that the use of the SoC-based RF Tuner will play a critical role in the hardware upgrade for LRIP-8. The SoC-based RF Tuner meets the product affordability and performance improvements specified by the JSF roadmap.

Controlled Volume Molding (CVM) Development Results in Lower Cost Parts for JSF

PERIOD OF PERFORMANCE:
November 2010 to August 2011

PLATFORM:
Joint Strike Fighter

AFFORDABILITY FOCUS AREA:
Composites Processing and Fabrication

CENTER OF EXCELLENCE:
CMTC

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STAKEHOLDER:
PEO (JSF)

TOTAL MANTECH INVESTMENT:
$200,000

R2369 — Controlled Volume Molding (CVM) Development for JSF Composite Seals and Structure

Objective

Lower Horizontal Tail and Bullnose Seals for the F-35 aircraft are Flight Science Critical structures; they are carbon fiber / bismaleimide (BMI) parts fabricated using hand lay-up and autoclave cure. The process uses female tools to control the external aerodynamic surfaces. A recent design change for these parts changed the resin system to Cytec 5250-4 High Temperature (HT). The geometry of these parts, combined with the extremely low viscosity of the HT resin system, results in substantial resin flow and build-up in the lower corner regions of these parts. As a result, a substantial percentage of these parts are scrapped or require re-work. On average, the cost to manufacture these parts using the HT BMI resin system has doubled relative to the parts fabricated with the standard BMI system.

The CVM process uses the same Lockheed Martin Aeronautics (LMA) specified prepreg materials and follows the same thermal cure cycle as the autoclave process. The CVM process does require the addition of a small quantity of the neat BMI HT resin (in liquid form). The process results in control of the outer mold line (OML) for aerodynamic requirements and adds better control of the inner mold line (IML) to provide more uniformly controlled pressure to the laminate in the tight confining areas of the mold.

The objective of this project was to enable a production process for manufacturing the Lower Horizontal Tail Seal and Bullnose components with the HT resin system by using an alternate manufacturing process designated as Controlled Volume Molding (CVM). Other complex shaped F-35 aircraft parts have been fabricated using CVM. Use of this process eliminated the resin management problem and resulted in lower cost parts for the F-35 project.

Payoff

The CVM has proven to be capable of repeatedly manufacturing - Bullnose Seal using the Cytec 5250-4 HT resin and prepreg systems, the potential benefits to the F-35 project are numerous and include reduced lay-up time, elimination of the autoclave cure, decreased number and complexity of rate tools required, elimination of IML machining and elimination of the female machining fixture.

This benefit is applicable to 1 of 4 part numbers per F-35 aircraft variant for a total of 12 part numbers across all variants. The ManTech project resulted in an estimated cost savings of $3,778 per part to the short takeoff vertical landing (STOVL) Lower Horizontal Bullnose. This cost savings was used to generate an estimated cost savings for the remaining 11 similar part numbers. The total estimated cost savings for the STOVL and carrier variant (CV) is expected to be $3M and for the conventional takeoff and landing (CTOL), the estimated savings is expected to be $8M for a total expected savings of $11M through LRIP11. With a project cost of $200K, the estimated Return on Investment (ROI) is 55.

Implementation

A total of 12 Lower Horizontal Tail and Bullnose Seals were fabricated for evaluation on the F-35 aircraft.ITT provided Lockheed Martin a report detailing the potential program cost savings for an ROI study. As of November 2011, the technology is in the formal change review process by the F-35 program office and Lockheed Martin with an anticipated implementation on these components in late 2012.

Decision Support System to Aid Decision-Makers to Support JSF Production

A2446 — Simulation-based Decision Support System for JSF Production

Objective

Lockheed Martin Aeronautics Company (LMAC) is in the process of ramping up production on the F-35 Joint Strike Fighter (JSF). Much analysis and planning has been performed in support of this ramp-up of production, including the development of a detailed Enterprise Production Model (EPM). The model enables LMAC to analyze the system and identify potential production issues that will have a negative impact on the baseline production plan. Although LMAC has this capability, it is extremely time-consuming to perform the significant number of simulation runs to find the issues and even more time-consuming to perform the experimentation required to develop a model-based contingency plan. The objective of this project is to implement a simulation-based Decision Support System (SBDSS) to aid the analyst and other decision-makers by semi-automating the experimentation performed with the simulation model. An optimization routine, or integrated search procedure, will be incorporated into the SBDSS that perturbs decision variables within the underlying simulation model in order to identify the best configuration and execution of the production system. Furthermore, the SBDSS will include stochastic variation when optimizing, thus accounting for risk levels when proposing an optimal or near optimal solution.

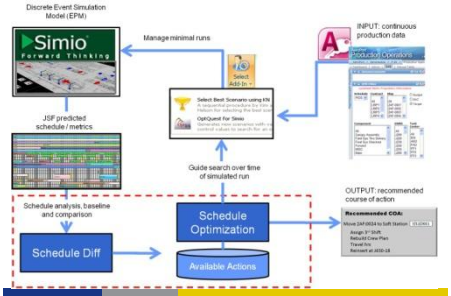
Payoff

The long-term benefit of a SBDSS will be manifested in advanced planning techniques while a short-term benefit will be seen in reductions in the number and length of production delays. Two types of cost savings are expected from this project: (1) decreased downtime (cost avoidance) and (2) decreased re-planning (cost savings).

SBDSS implementation is expected to reduce lost days by approximately 50%. The cost avoidance due to workstation delays being decreased is projected to be $3.67M/year. Cost savings due to expedited re-scheduling reviewing is projected to be $173K/year. This results in a five-year net present value ROI of 18.6:1.

Implementation

The project's transition and implementation are expected to occur in phases as follows: (1) nine months after project commencement, the prototype SBDSS, integrated with the existing EPM will be demonstrated to LMAC and project stakeholders. SBDSS-drive decision variable manipulation will be demonstrated and test scenarios identified in Phase I will be executed to illustrate the connectivity between the SBDSS and the EPM. (2) 18 months after project commencement, Corrected Operative Schedule SBDSS demonstration and End User Transition (EUT) will occur. The SBDSS, enhanced with the capability to improve the operative schedule will be demonstrated to LMAC and project stakeholders. (3) 24 months after project commencement, a full-scale SBDSS demonstration will occur. The fully developed SBDSS will now provide a dashboard for insight into baseline schedule risk and alterations made to the operative schedule. All developed software tools and documentation will be delivered to LMAC who will be responsible for conducting full- scale implementation of the technology. Full implementation of technology is expected at the conclusion of the project – March 2013.



PERIOD OF PERFORMANCE:
February 2011 to February 2013

PLATFORM:
Joint Strike Fighter

AFFORDABILITY FOCUS AREA:

CENTER OF EXCELLENCE:
iMAST

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PEO (JSF)

TOTAL MANTECH INVESTMENT:
$500,000

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Other Air Platforms Projects

Optimized Composites Manufacturing for Wing Skins to Result in Reduced Scrap and Rework

PERIOD OF PERFORMANCE:
June 2008 to March 2012

PLATFORM:
Other Air Platforms

AFFORDABILITY FOCUS AREA:
Composites Processing and Fabrication

CENTER OF EXCELLENCE:
CMTC

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STAKEHOLDER:
PMS 265

TOTAL MANTECH INVESTMENT:
$1,022,000

A2234 — Affordable F/A-18 Wing Skin Manufacturing

Objective

F/A-18E/F wing skin production is experiencing continuing manufacturing issues related to ply waviness associated with cocured wing access cut-out steps, also known as rabbets. These issues have resulted in undesirably high scrap rates which have at times threatened aircraft delivery schedules. Two near-term manufacturing technologies were identified to have the potential to solve the F/A-18E/F ply distortion quality issues: (1) staging 2 to 4 of the composite plies directly under the rabbet step prior to part cure and (2) die-stamp cutting of the ply-stack which terminates at the rabbet step.

Near-term manufacturing solutions are very desirable for the F/A-18E/F program because they can be fully developed in the 2008 – 2012 timeframe and implemented into production with a minimum of structural verification testing, thus enabling a rapid resolution to the program's ongoing ply distortion quality issues. The project objective was to investigate the two near-term manufacturing technologies to prevent rabbet ply distortion, ply staging, and multi-ply stack stamping, then down-select to the optimum technology for the F/A-18E/F wing skins and trailing edge flaps, and fully demonstrate production capability. After a down selection, technology (1) proved to be the most viable.

Payoff

A primary benefit resulting from this project was the production of wing skins and trailing edge flaps with reduced scrap, disposition, and rework costs. Additionally there were operation and support (O&S) cost savings to the Fleet. The Return on Investment (ROI) for wing skins is estimated to be about 5 based on a rough order of magnitude (ROM) cost analysis performed. This ROM estimate was based on 40 aircraft per year, 4 upper wing skins per aircraft, a 10% upper wing skin scrap rate, a 30% part disposition rate, $40K per skin cost, $10K disposition cost, and a three-year timeframe.

Implementation

After investigation of the two near-term manufacturing technologies, staging 2 to 4 plies directly under the rabbet step prior to part cure was found to be the more viable of the two options, and this option was down selected. The project will fabricate and test a DD62 trailing edge flap article to demonstrate acceptable fabrication with the improved process established in the project. Detailed manufacturing planning changes will be made, including possible process specification modifications and drawing changes reflecting the selection of ply staging technology. These activities will be conducted in parallel with the ManTech project with associated costs taken care of by the F/A-18E/F Program and part manufacturer. Resulting technology is expected to be implemented into the production line in late 2012

Significant Cost Avoidance Resulted from Manufacturing Improvements for the AIM-9X Active Optical Target Detector

A2295 — AIM-9X AOTD Laser Assembly ManTech

Objective

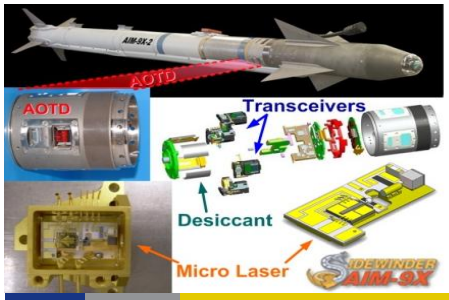
The AIM-9X "Sidewinder" air-to-air missile uses an optical proximity fuse, the DSU-41B Active Optical Target Detector (AOTD) to detonate the missile's charge near its target. The AOTD is a complex optical and electronics system that requires numerous labor-intensive manual assembly and test steps. This project targets improvements of the manufacturing process and automated in-line test procedures for the AOTD micro laser, for the AOTD transceiver unit, and the primary AOTD unit. The Electro-Optics Center (EOC) is managing a sub-contract with Raytheon Missile Systems, the government's AIM-9X systems contractor, to address these manufacturing technology improvements.

Payoff

This project is focused on the improvement of the manufacturing process, in-line test procedures, and manufacturing yield of the AOTD micro laser assembly. This diode-pumped solid state laser exhibited yield and reliability problems which are being addressed by improvement of the pump laser diode solder process and use of additional in-line tests that eliminate failing laser diodes prior to the labor intensive optical assembly. The AOTD transceiver manufacturing process now uses less expensive spreader lenses that improve the optical performance. Connectors, wire harnesses, and desiccant packages inside the complex AOTD unit are being redesigned to allow for easier, less labor-intensive unit assembly and testing, increased manufacturing yield, and, subsequently, increased unit performance and reliability. Raytheon Missile Systems projects that the cost avoidance will be in excess of $20M for the AIM-9X missile based on these improvements.

Implementation

The AIM-9X air-to-air missile is matched to the F/A-18 C and F, F-15C, F-22, and F-35 (JSF) airframe. The most recent version, AIM-9X Block II is on track for implementation on the F-35 Joint Strike Fighter and the F/A-18 variants. The Sidewinder missile ties into the F/A-18's Joint Helmet Mounted Cueing System and the JSF's Helmet Mounted Display Targeting System. The AOTD improvements addressed under this effort are slated for implementation starting in early FY12 with Lot 12 missile variant.



PERIOD OF PERFORMANCE:
October 2009 to April 2011

PLATFORM:
Other Air Platforms

AFFORDABILITY FOCUS AREA:
Electronics Processing and Fabrication

CENTER OF EXCELLENCE:
EOC

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STAKEHOLDER:
PMA 259

TOTAL MANTECH INVESTMENT:
$2,250,000

Fiber Optic Manufacturing and Installation Processes Improved for E-2D

PERIOD OF PERFORMANCE:
April 2010 to June 2011

PLATFORM:
Other Air Platforms

AFFORDABILITY FOCUS AREA:
Electronics Processing and Fabrication

CENTER OF EXCELLENCE:
EOC

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STAKEHOLDER:
PMA 231

TOTAL MANTECH INVESTMENT:
$312,000

A2303 — Fiber Optics Manufacturing Process for the E-2D

Objective

The Northrop Grumman E-2 Hawkeye is an all-weather, carrier-based, tactical early warning aircraft. This platform has been progressively updated to the latest variant, the E-2D Advanced Hawkeye. The E-2D uses fiber optics to advance the data transfer capacity of its internal networks in providing battle management, theater air and missile defense, and multiple sensor fusion capabilities. The E2 aircraft has not used fiber optics extensively previous to the D upgrade. Minimal effort had been spent developing specifications and processes for deployment of fiber optic infrastructure in the E-2D. Challenges have been encountered during manufacturing and installation activities.

The objective of this project was to modernize the process and performance for production of fiber optic cable assemblies associated with the E-2D project. The goals were to: (1) reduce the varieties of hardware and specifications used in fiber optic cable assembly designs, (2) apply best aerospace industry manufacturing quality and quality management principles to the production and installation of fiber optic cable assemblies, (3) where possible, identify key component level metrics that predict installed cable assembly failure, to eliminate defects early, (4) demonstrate awareness and effective use of the latest assembly and test methods and technology, (5) define a manufacturing process for providing installed fiber optic cable assemblies which is self sustaining and continuously improving per the tenets of AS9100, and (6) apply learning into quality assurance and process specification improvements.

Payoff

This project modernized and improved processes used at Northrop Grumman for fiber optic cable manufacturing and installation in the E-2D. Possible savings per aircraft is expected to yield $53,910 in labor and $21,000 in materials, for total estimated savings per aircraft of $75K. This results in $5.6M in possible savings for the entire E-2D fleet, not including improvements in availability.

Implementation

Upon the successful acceptance of the technology by the acquisition Program Office (PO) / Program Executive Officer (PEO), the industrial facility management, and the relevant Navy Technical Codes, the results of this technology will be used to generate an Engineering Change Proposal (ECP) for the E-2D platform.

The project made improvements to existing manufacturing processes by: decreasing cost and clarifying requirements, establishing a baseline process, identifying metrics, and driving metrics with process improvements. Project activities monitored data and performed engineering work related to process improvements. Implementation (i.e. design documentation and production process updates) will be performed by Northrop Grumman subsequent to an approved ECP. Implementation of the improvements is expected in FY12. Implementation is targeted for E-2D Advanced Hawkeye and PMA 231 Hawkeye / Greyhound Program Office.

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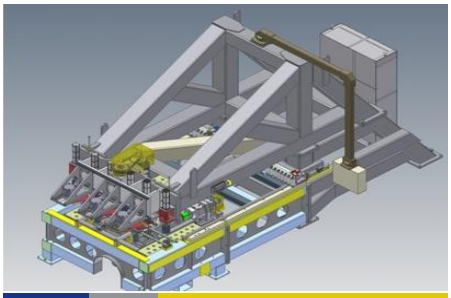
NAVY MANTECH
Manufacturing Technology Program

Other Sea Platforms Projects

Machine Design Modification Extends Capabilities for Low-Cost Friction Stir Welding



PERIOD OF PERFORMANCE:
December 2009 to January 2012

PLATFORM:
Other Sea Platforms

AFFORDABILITY FOCUS AREA:
Welding and Joining

CENTER OF EXCELLENCE:
NMC

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STAKEHOLDER:
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TOTAL MANTECH INVESTMENT:
$2,534,000

S2321 — Expanded Capabilities for Low-Cost Friction Stir Welding

Objective

The Joint High Speed Vessel (JHSV) design incorporates the use of large integrally stiffened aluminum panels produced via friction stir welding (FSW). If panels are produced by off-site FSW vendors, the sizes of the panels are limited due to shipping constraints. Assembling smaller panels via conventional welding methods is costly and frequently results in excessive distortion and other quality issues. Austal USA is interested in developing an on-site FSW capability to reduce cost and increase quality of these panels. A low-cost friction stir welding (LC-FSW) system was developed and demonstrated for Freedom Class LCS applications during a previous Navy Metalworking Center (NMC) project (S2100). That machine design is being modified for application in JHSV construction. This project will develop a detailed design for an extended capabilities LC-FSW machine, develop optimal processes and tooling for JHSV products, and assist in startup and training of the new system at Austal USA.

Payoff

This project will enhance the producibility of lightweight aluminum structures on JHSV, which will reduce the cost of the ships, improve welded joint quality, and reduce vessel weight because there is no filler metal added to the weld as with traditional welding processes. These structures will be produced with reduced weld distortion and weld defects, which decrease rework, schedule impacts, and acquisition costs. Estimated cost savings are nearly $1.8M per year for the JHSV Program. In addition, the technical developments could potentially be leveraged for application to other platforms with aluminum structures.

Implementation

NAVSEA and ABS are addressing updated inspection requirements. It's expected that the new requirements will be issued early in 2012 and that Austal will decide whether or not to procure the ECAP FSW system shortly after that.

White Light Scanning System for Inspecting Shaft Tapers to Reduce Total Ownership Costs

S2365 — Main Propulsion Shaft Taper Inspection

Objective

Power is applied to submarine and aircraft carrier main propulsion shafts through a tapered connection between the shaft and the inboard coupling. To prevent mismatch, tapers are inspected using taper ring and plug gauges that are heavy and cumbersome. Each taper requires from six to 10 inspections as the taper is carefully shaped to the correct contour. Eight work shifts and up to 66 labor hours can be saved if these gauge inspections are eliminated. Taper gauges cost $615K per set and must be refurbished every three years at a cost of $70K. Separate gauges must be used for every ship class. This Navy Metalworking Center project will evaluate and develop white light scanning technology for inspecting submarine and aircraft carrier shaft tapers. This will eliminate the labor-intensive use of costly single-purpose gauges and replace them with less costly systems that allow for more rapid inspections. The project team will work with industry to identify the most promising white light scanning system, develop a prototype for shipyard use, and optimize the prototype in response to testing and evaluation

Payoff

The four naval shipyards will see a cost savings of over $1M just by eliminating the purchase of the VCS taper gauges. They will see an additional cost savings of $400k per year by eliminating the need to maintain the existing taper gauges. The labor to perform the inspections will be reduced by 90 percent by eliminating the lifting and handling process and by reducing the time required to perform taper inspections. Employee safety will benefit from eliminating the repeated lifting and handling of 750 pound gages.

Implementation

Implementation will occur in the fourth quarter of FY12 as Norfolk Naval Shipyard uses the prototype system delivered to them for evaluation. The other Navy shaft refurbishment facilities will also implement the results as the Navy eliminates the current gauge process.

PERIOD OF PERFORMANCE:

November 2010 to November 2012

PLATFORM:

Other Sea Platforms

AFFORDABILITY FOCUS AREA:

Automated Tools

CENTER OF EXCELLENCE:

NMC

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STAKEHOLDER:

PEO (Ships)
NAVSEA 04X

TOTAL MANTECH INVESTMENT:

$948,000

Improved Packing Consistency Meets Navy's Requirements for KE-ET Projectile

PERIOD OF PERFORMANCE:
March 2011 to September 2011

PLATFORM:
Other Sea Platforms

AFFORDABILITY FOCUS AREA:
Facilities and Industrial Processes

CENTER OF EXCELLENCE:
NMC

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STAKEHOLDER:
NSWC IHD – Picatinny Detachment

TOTAL MANTECH INVESTMENT:
$50,000

R2450 — Manufacturing Assessment of Tungsten Shot for the MK 182 KE-ET

Objective

Persistent inconsistencies have existed in the total mass of tungsten shot packed into the body of the 5"/54 caliber Mk 182 Kinetic Energy Electronic Time (KE-ET) projectile. These mass inconsistencies result in range errors of up to 22 yards greater than the baseline 2003 projectile configuration. The Conventional Ammunition Division (G2) Naval Surface Warfare Center Indian Head Division (NSWC IHD), in conjunction with the Naval Surface Warfare Center Dahlgren Division (NSWCDD), has made several attempts to correct the problem; however, no documented and manufacturer-independent assessments have been conducted to demonstrate that the associated changes have been successful in meeting the Navy's mass consistency requirements. Before proceeding with further development/procurement of KE-ET rounds, resolution of the mass inconsistency issue must be demonstrated. This project's objective was to ensure that tungsten shot is produced to the tight mass tolerance, shape and size distribution required of the round.

Payoff

Successful implementation of the production improvements are expected to lead to improved mass consistency of the loaded projectiles. This in turn will provide improved performance consistency of the MK 182 KE-ET projectile. Providing the desired consistency, this project is estimated to save the Navy approximately $1.4M by eliminating the need to download and reassemble nonconforming projectiles.

Implementation

Potential improved processing methods were defined for potential use by Crane Army Ammunition Activity (AAA) during loading of the next lot of rounds to be processed in calendar year 2012

New Padeye Design Will Avoid Costs in Submarine Overhaul

R2457 — Alternatives to Temporary Padeyes

Objective

Portsmouth Naval Shipyard (PNS) is seeking alternatives to the current design of temporary padeyes used during submarine overhauls. The current padeye is fillet welded and requires 160 man-hours of labor to install and then remove. The Navy Metalworking Center (NMC) is working with PNS and the other naval shipyards to develop and evaluate an alternative to the current temporary padeyes that would reduce labor and material costs. The leading candidate for this application is a swivel hoist ring mounted on a threaded HY-80 stud. Work includes developing optimized stud welding parameters and selecting the correct swivel hoist rings. The stud-mounted swivel hoist rings are being tested to demonstrate that they consistently meet lifting and handling requirements. This project will also identify and determine the effects of any errors that might be made during installation. Previous research conducted at PNS indicates that this technology is very likely to be successful.

Payoff

Based on PNS data, there is a potential cost avoidance of $235K per overhaul from reducing the labor associated with installing and removing padeyes. Although the largest part of the cost reduction is from reducing the welding labor, there are also significant savings to be realized by reducing the effects of installation and removal on the special hull treatment and internal hull insulation. Over a five-year period, the estimated cost avoidance is approximately $2.4M.

Implementation

Although, the results of this project will be applicable to all submarine classes, the majority of the savings will be realized during overhauls of Los Angeles Class submarines. The solution will be implemented at PNS in June 2012 for the overhaul of the USS TOPEKA (SSN 754). The other three naval shipyards are also expected to implement the results. Implementation will require approval from shipyard Lifting and Handling authorities and procedure changes.

PERIOD OF PERFORMANCE:
June 2011 to December 2011

PLATFORM:
Other Sea Platforms

AFFORDABILITY FOCUS AREA:
Facilities and Industrial Processes

CENTER OF EXCELLENCE:
NMC

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STAKEHOLDER:
NAVSEA 04XP

TOTAL MANTECH INVESTMENT:
$196,000

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NAVY MANTECH
Manufacturing Technology Program

Business Enterprise Projects

Identification of Barriers to Open System Architecture in Naval Acquisition Targeted

PERIOD OF PERFORMANCE:
January 2010 to December 2010

PLATFORM:
Business Enterprise

AFFORDABILITY FOCUS AREA:
Automated Tools

CENTER OF EXCELLENCE:
B2PCOE

POINT OF CONTACT:
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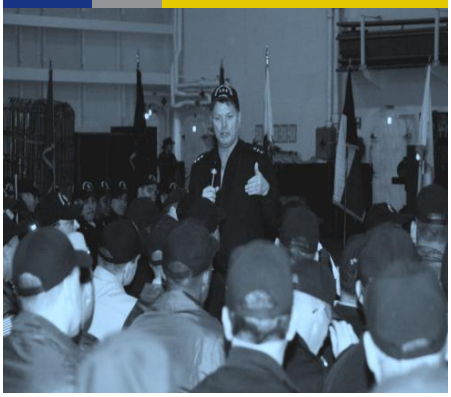
TOTAL MANTECH INVESTMENT:
$47,000



A2299 — Open Systems Architecture

Objective

The objective of this Benchmarking and Best Practices Center of Excellence (B2PCOE) project was to complete Open Architecture (OA) interviews with discussion centered on identification of the barriers which impede the successful implementation of OA in Naval Acquisition and what industry has accomplished in eliminating those identified barriers. Naval OA Champions and commercial companies and DOD prime contractors with similar targeted markets and products were interviewed. Additionally the objective was to generate recommended language for SECNAV INS 5000.2 to invoke an OA implementation requirement for Naval Acquisitions and design practices.

Payoff

Successful implementation of OA concept in acquisition will allow the delivery of new and updated capabilities to the warfighter more rapidly and also allow the Navy to capitalize on emerging technology in incorporation of new technology with a faster design and new development processes. OA implementation allows for drop-in replacements from multiple sources and fosters innovation, increased competition, decreased acquisition and replacement cost and incorporates modular design and design disclosure.

Implementation

The implementation target of interest was a broad Navy sector that is represented by the OA Alliance. Best practices were transitioned through published best practices that specifically broke down barriers or further proliferates current integrated best practices. Specific efforts were put in place to measure the success associated with implementing these best practices into specific Navy platforms.

Use of Lead Free Electronics Addressed in the Manhattan Project – Phase 2

B2315 — Lead-Free Electronics (Manhattan Project) Phase 2

Objective

The primary issue associated with the use of lead-free materials is that the reliability of lead-free aerospace and defense products in typical harsh environments and long product lives is unquantified. Aerospace and defense product lives are often measured in decades compared to the typical commercial product life, which is measured over a few years. These factors contribute to the risk associated with lead-free electronics and the uncertainty of how to adequately address them within current required product life-cycles. The objective of Phase 2 of this Lead-Free Electronics effort was to deliver a roadmap of research and development projects that address the lead-free electronics knowledge gaps identified in Phase I of this project and to allow lead-free mitigation and implementation to be utilized by Industry providers for Navy and DOD electronic hardware.

Payoff

Through the efforts of the Benchmarking and Best Practices Center of Excellence (B2PCOE), a concerted and organized plan to train providers and vendors about the best lead-free manufacturing practices and a briefing on the technological roadmap was initiated. Best practices were captured and documented which articulated the strategy to mitigate the risks associated with lead-free electronics usage in high-reliability, high-performance aerospace and defense systems. Industry and the Government worked together to integrate the set of best practices ascertained from the project study, for the design, manufacture, and sustainment of electronic hardware products. These best practices were made available to all customers through the B2PCOE and can be used to provide uniform guidance for hardware providers and end-users in order to establish a common framework for actively managing the unplanned intrusions of lead-free electronics into current aerospace and defense weapon systems.

Implementation

Implementation of the lead-free electronics best practices was encouraged throughout the defense industry, their suppliers, and the government depot and sustainment centers. Lead-Free Best Practices should be employed across all Navy systems utilizing electronic manufactured assemblies.

A Technical Focus Team (TFT) was formed and recommended that the entire $95M research plan compiled in the Manhattan Project Phase 2 roadmap should be immediately funded in the light of the continuing costs incurred by the DOD to attempt to mitigate lead-free electronics risks without it. The final result of these OSD deliberations was to recommend that $73M worth of the roadmap suggested projects should be funded. In addition, the first procurements of the Navy Mark 41 vertical launch systems (VLS), from a contract awarded to Lockheed Martin in 2010 for installation on new construction DDG 51 fleet enhancement vessels, shall follow the lead-free best practices as outlined in Manhattan Project documentation. Manhattan Project results are also being used to help initiate these same requirements into DOD procurement policy through the Government-Industry PERM consortium of the Avionics Industry Association (AIA). The implementation target for this effort, besides the specific case of the Mark 41 VLS, is defense industry-wide with a direct impact on surface ship combat systems. The integration of the best practices will have a direct impact on the costs associated managing lead free processes and materials.

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PERIOD OF PERFORMANCE:
February 2009 to December 2010

PLATFORM:
Business Enterprise

AFFORDABILITY FOCUS AREA:
Electronics Processing and Fabrication

CENTER OF EXCELLENCE:
B2PCOE

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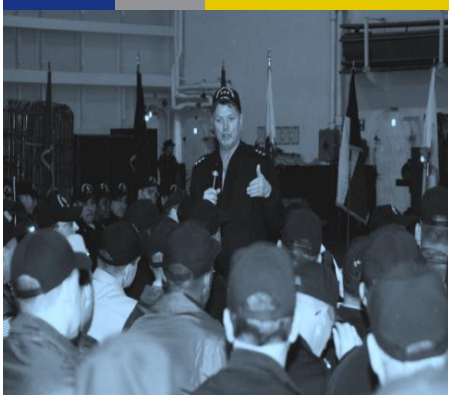
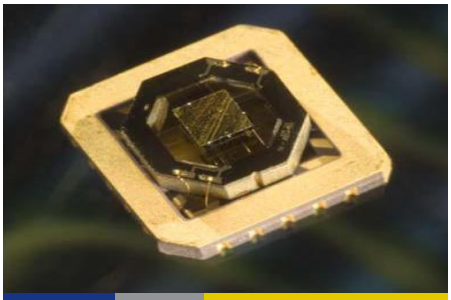
TOTAL MANTECH INVESTMENT:
$153,000



Benchmarking the Manufacturing Process of Chip Scale Atomic Clocks



PERIOD OF PERFORMANCE:

January 2010 to January 2012

PLATFORM:

Business Enterprise

AFFORDABILITY FOCUS AREA:

Electronics Processing and Fabrication

CENTER OF EXCELLENCE:

B2PCOE

POINT OF CONTACT:

Mr. Michael D. Frederickson
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mfrederickson@aciusa.org

STAKEHOLDER:

U.S. Army CERDEC

TOTAL MANTECH INVESTMENT:

$55,000

B2336 — Chip Scale Atomic Clock

Objective

The purpose of this Benchmarking and Best Practices Center of Excellence (B2PCOE) investigation is to assess the present design concept for high volume manufacturing processes and quantify the associated risk for the production of Chip Scale Atomic Clocks (CSACs). The current generation of atomic clocks does not meet the future needs of the military due to their size, cost, weight, and power consumption. Prototype versions of CSACs have demonstrated the feasibility of obtaining equivalent accuracy with significant reduction in the drawbacks mentioned above.

The goal of this effort is to identify a best practice for the production of CSACs.

Payoff

The expected benefits of this effort will be recommendations of best practices for the production of CSACs with reduced size, weight, cost, and power consumption due to improvements in the manufacturing process.

Implementation

Recommendations will be given to the Navy and other DOD agencies. Other programs requiring smaller, low power atomic clocks will benefit from the manufacturing best practices identified in this effort.

Sensor Networks to Monitor Energy Usage in Shipbuilding Environments

B2343 — Sensor Networks for Energy Management in Shipbuilding

Objective

The growing concern over the stability of the global energy markets, availability of energy, and environmental issues highlights the need to address energy consumption as it pertains to the shipbuilding industry. Geopolitical instability, climate change, long-term supply, and the threat of natural disasters all contribute to problems associated with the supply and demand of fossil fuels. The objective of this Benchmarking and Best Practices Center of Excellence (B2PCOE) effort is to reduce the energy use in a shipyard environment by evaluating and identifying the best practices for sensor networks for energy management in shipbuilding.

The Sensor Networks for Energy Management project objective is to reduce the cost of energy consumed in shipbuilding operations by measuring energy usage at the load point in a shipbuilding operation sufficient to determine : a the process contribution to the overall energy consumption and to recognize visible shifts in energy consumption during processing that can identify uncontrolled energy consumption issues.

Payoff

The development of best practices for using sensor networks to monitor the energy usage within a shipbuilding environment will enable, for the Navy and its shipbuilders, the following benefits: (1) the potential for reduced costs due to improved accuracy of energy consumption measurement to ensure the large energy consumers are being targeted for improvement; (2) the automation of data capture for tracking for Navy and other outside auditing; and (3) accurate data from higher efficiency systems and detailed metering devices to identify opportunities for further reduction in energy consumption.

Implementation

The B2PCOE will develop and integrate a set of benchmarks and best practices applicable for energy monitoring in a shipyard environment. These benchmarks and best practices will be made available to all interested entities through the B2PCOE.

PERIOD OF PERFORMANCE:

June 2010 to July 2012

PLATFORM:

Business Enterprise

AFFORDABILITY FOCUS AREA:

Facilities and Industrial Processes

CENTER OF EXCELLENCE:

B2PCOE

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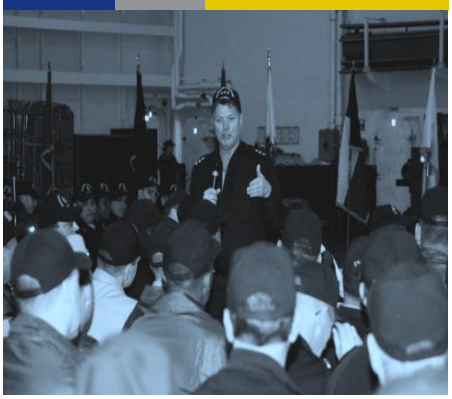
TOTAL MANTECH INVESTMENT:

$372,000



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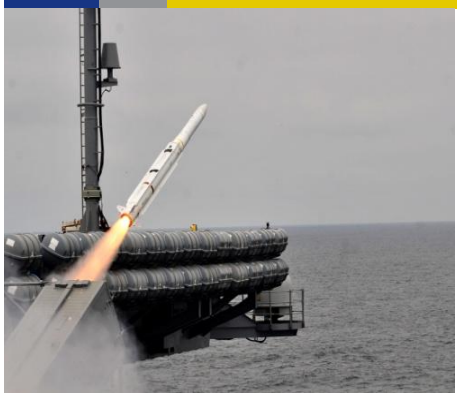
NAVY MANTECH
Manufacturing Technology Program

Energetics Projects



Sustainable and Reliable Production Capability for RSI-007 Molding Powder

PERIOD OF PERFORMANCE:
July 2010 to December 2012

PLATFORM:
Energetics

AFFORDABILITY FOCUS AREA:
Not Applicable

CENTER OF EXCELLENCE:
EMTC

POINT OF CONTACT:
Mr. Charles R. Painter
(301) 744-6772

STAKEHOLDER:
PMA 259

TOTAL MANTECH INVESTMENT:
$808,000

A2350 — RSI-007 Scale-up for Manufacture (RSI-007)

Objective

The objective of this project is to develop a sustainable and reliable production capability for RSI-007 molding powder. Work will also be completed that will reduce waste from the process and reduce hazardous chemicals used in processing. RSI-007 is a high-energy, CL-20-based explosive that enables miniaturization of and increased output from low energy exploding foil initiators (LEEFIs). RSI-007 based LEEFIs are used in multiple weapon systems including AIM-9X, RAM, ESSM, Standard Missile, Spider, FBM ordnance, FMU-139 Product Improvement Program, MEMS Distributed Initiation Systems and SECAT Advanced Lightweight Torpedo Program.

Payoff

Successful completion of this effort will produce multiple benefits. Production volume will be higher as new production capability will be raised ten-fold. The cost of RSI-007 will be decreased from a current price of $3930/lb to $1140/lb (a 70% decrease). Halogenated solvents and processing fluids will be eliminated resulting in cleaner processing with safer solvents. Understanding of manufacturing parameters will be improved through designed experiments to determine the influence of processing variables on product quality. The particle size will be controlled more tightly and tailored to meet manufacturing needs. Overall, the production of the high energy output RSI-007 will allow for the miniaturization of fuze systems for various munitions.

Implementation

The Navy's AIM-9X program (PMA-259) will serve as the coordinating and transition program for the scale-up of RSI-007. The program is planning on using RSI-007 as part of the next generation warhead for AIM-9X, which is currently under development and uses the RSI-309 initiator and RSI-260 detonator. AIM-9X will be responsible for coordinating all of the $231K in funding for 25 percent of the program support effort. The completed RSI-007 scaled-up process is planned for implementation at the contractor facility in 3Qtr 2012.

The RSI-007 developed for scale-up purposes as part of this project will be readily used in the LEEFI systems produced by Reynolds Systems. In fact, it is already specified for use in several DOD programs, including RAM, Standard Missile, ESSM, and SPIDER. These programs require a larger quantity than is currently being produced.

DBX-1 Manufacturing Process Scale-Up to Produce Environmentally Benign Copper-Based Lead Azide Replacement

A2375 — Manufacturing Evaluation and Scale-Up of DBX-1

Objective

Lead azide (LA) is used in most chemical detonators as the initial shock wave generating compound for detonation of subsequent main explosive charges. Despite being an effective energetic material, LA has drawbacks associated with its use: (1) LA contains 71% lead, a toxic heavy metal that is released to the environment during production and use, (2) LA is unstable in non-hermetic munitions applications (forming copper azide) and, because of this, has been limited in use by NAVSEA 8020.3A, and (3) currently, there is very limited domestic production of LA with DOD relying on an aging and dwindling stockpile to support its needs. DBX-1 is an environmentally benign copper- based LA replacement which has recently completed a NAVSEA 8020.5C qualification project. The objective of this project is to optimize synthesis techniques, scale-up to a 100 gram batch-size level, and generate a final product specification for DBX-1.

Payoff

This project will establish both a remote manufacturing process and specification for DBX-1 at Pacific Scientific Energetic Materials Company in Chandler, AZ. These procedures will be transitioned to the Navy to enable production of DBX-1 for use in items of military interest. The project will provide a method for preparation of an environmentally friendly drop-in replacement for LA without the potential for copper azide formation. More importantly, a “green” replacement for LA would establish a U.S. manufacturing capability and eliminate this single point failure source in the fuze / detonator supply chain

Implementation

The Cartridge Actuated Devices (CAD) / Propellant Actuated Devices (PAD) (CAD/PAD) group at the Naval Surface Warfare Center-Indian Head (NSWC-IH) has supported development of DBX-1 and has a plan for qualification of end-item applications to begin in late 2011. There are over 200 distinct CAD/PAD applications which can use DBX-1 as a replacement for LA including the 25mm Mk210, M792, and PGU-25; 30mm Mk266; and 40mm M430, M433, and M918 detonators. DBX-1 can also be used in aircraft pyrotechnic transfer lines and fire extinguisher cartridges for CADs/PADs on various airframes (i.e., F-18, V-22 and other airframes used by all DOD components). In addition, ARDEC has proposed and initiated testing DBX-1 in M55 and M100 detonators as well as in NOL-130 primer mixes.

Initial qualification testing of DBX-1 will be in the F-18 Fire Extinguisher cartridges followed by gap tests between TLX cord and DBX-1 loaded high energy tips to ensure reliable initiation transfer in both directions.

PERIOD OF PERFORMANCE:
November 2010 to September 2012

PLATFORM:
Energetics

AFFORDABILITY FOCUS AREA:
Not Applicable

CENTER OF EXCELLENCE:
EMTC

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STAKEHOLDER:
PMA 201
PEO (U&W)

TOTAL MANTECH INVESTMENT:
$1,396,000

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NAVY MANTECH
Manufacturing Technology Program

REPTECH Projects

Erosion Resistant Coatings Avoid Costs and Improve Service Life of 1st Stage Compressor Components

PERIOD OF PERFORMANCE:
April 2005 to December 2010

PLATFORM:
REPTECH

AFFORDABILITY FOCUS AREA:
Not Applicable

CENTER OF EXCELLENCE:
iMAST

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tdb14@psu.edu

STAKEHOLDER:
NAVAIR

TOTAL MANTECH INVESTMENT:
$1,650,000

A2087 — Erosion Resistant Coatings for Stage 1 Compressor Components

Objective

When aircraft take-off and land, vortexes are formed which often result in the incorporation of hard solid particles of sand, dust, and ice with the airflow. 1st stage compressor components of the T700 (AM355) helicopter engines exhibit leading edge (LE) curl damage resulting from impingement of large diameter (>1000 microns (1mm)) sized erosive media. Decreased service life and increased maintenance costs occur as the realized time-of-flight (2,500 hours) is only half of the expected (5,000 hours) and, in some aggressive environments (like Iraq and Afghanistan), as few as 100 hours (50 times less than expected) before significant maintenance is required to return the aircraft to flying status. In addition, the AM355 base alloy experiences degradation due to corrosion. The objective of this project was to better understand the leading edge curl phenomena which should allow easier design and manufacturing process of an erosion resistant coating system that minimizes or eliminates leading edge curl associated with large particle impingement (i.e., sand particles).

Payoff

The anticipated cost avoidance for the SH-60B, SH-60F, and HH-60H helicopters is calculated based on the total number of engine removals to be avoided due to increase in mean time since engine removal associated with the improved configuration. Over a five year period, the total cost avoidance is anticipated to be $10.25M for a project Return on Investment of 6.2.

Implementation

Prior to scaling up the manufacturing process, coupons were coated and evaluated to ensure good adhesion, ability to meet thickness requirements, and overall erosion and corrosion resistant properties. The coated samples were evaluated under the same test conditions that resulted in leading edge deformation of the uncoated. Significant effort was involved in optimization of the coating system, as well as scaling-up a manufacturing coating process. Using a cathodic arc physical vapor deposition (PVD) process, MDS Coating Technologies scaled the coating process to allow coating of a very complex geometric component.

A variety of erosion resistant coating systems (including the ER-7 and next generation coatings (NGC)) were applied to T700 compressor blisks and test articles with success. Based on optimized performance, the NGCv4 coating system was down-selected as the coating system. Several iterations allowed for optimization of various coating morphologies for the configuration and operating environment of the T700 1st stage blisk, an approximately 2x improvement in the deformation and erosion performance was obtained. In addition, the NGCv4-coated T700 blisk component showed no corrosion after 14 days of testing under ASTM B117 conditions (vs significant corrosion for the uncoated component). The NGCv4 offers multifunctional capabilities of both erosion and corrosion performance. NGCv4 is currently undergoing vendor substantiation by GEA for the T58 1st stage rotor blade. The NGCv4 is also completing test and evaluation by Rolls Royce (RR) / NAVAIR for the V-22's AE1107 engine, TACOM / HWL for the Abrams Tank AGT1500 engine, Special Ops / HWL / Boeing for the H-47's T55 engine, and the USAF / NAVAIR / RR for the C-130, E-2's T56 engine. In addition, the Program Office has provided funds for performing a T700 sand ingestion test schedule to be completed January 2012.

Blade Repair and Inspection Process Saves $750K per Year

A2177 — F402 Compressor Blade Repair

Objective

Commercially available additive repair and inspection processes are being evaluated for reducing maintenance costs for the high pressure compressor (HPC) blade tips in the F402 engine that powers the AV-8B Harrier. Fleet Readiness Center-East (FRC-East) repairs and overhauls the F402 engine. The project objective is to evaluate and implement a mature additive repair process and non-destructive inspection technique for the repair of high pressure compressor (HPC) blade tips in the AV-8B Harrier's F402 engine.

Payoff

The primary payoff is cost avoidance by repairing worn blade tips instead of replacing them. In addition, implementation of the developed technology will lessen the dependence on the original equipment manufacturer (OEM) for supply of new blades. The repair and inspection process will increase the operational fleet size and save up to $750K per year in operational costs associated with replacing blades. A successful repair process will impact other failure modes (e.g. foreign object damage) in the F402 engine, as well as other aero-engine systems across the DOD

Implementation

The outcome of this project will be a repair and inspection process for HPC blade tips that provides flight assurance to the F402 Fleet Support Team (FST) and Fleet Readiness Center (FRC)-East, while reducing life-cycle maintenance costs and mitigating a future supply chain crisis. Implementation is achieved when: (1) FRC-East acquires the equipment necessary to perform the repair and inspection process; (2) FRC-East produces qualification test samples according to the ManTech-developed Pilot Qualification Plan; and (3) the F402-FST and PMA 257 qualify the repair and inspection process. Final implementation is expected to occur in FY13

PERIOD OF PERFORMANCE:
March 2007 to July 2012

PLATFORM:
REPTECH

AFFORDABILITY FOCUS AREA:
Metals Processing and Fabrication

CENTER OF EXCELLENCE:
iMAST

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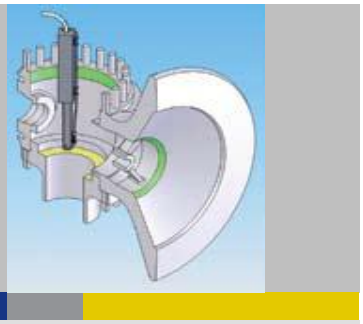
tdb14@psu.edu

STAKEHOLDER:
PMA 257

TOTAL MANTECH INVESTMENT:
$824,000

Man-Portable, Wire-Based, Deep-Bore Clad Tool for Shipboard Repair of MSW/ASW Valves



PERIOD OF PERFORMANCE:
May 2007 to May 2012

PLATFORM:
REPTECH

AFFORDABILITY FOCUS AREA:
Welding and Joining

CENTER OF EXCELLENCE:
iMAST

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STAKEHOLDER:
NAVSEA
Pearl Harbor Naval Shipyard
Norfolk Navy Shipyard
Puget Sound Naval Shipyard
NUWC Keyport

TOTAL MANTECH INVESTMENT:
$1,846,000

S2178 — In-Situ Strategic Repair Process

Objective

In many cases, significant cost savings can be realized if long-lasting component repairs can be executed on the ship or in the field. The goal of this effort is to develop and implement technologies that enable in-situ field or shipboard repair of various components for the Navy and other services. The primary short-term objective is to develop and implement cladding tools and methodologies for shipboard repair of main seawater (MSW) / auxiliary seawater (ASW) hull and back-up valves. This will be realized by developing a simple, flexible approach to clad repair that keeps the man-in-the-loop where appropriate and utilizes mechanization when justified. Development of such flexible techniques will pave the way for this technology to address a broader range of needs within the repair community.

The strategy and tools have been formulated based on feedback from all four Navy shipyards (Pearl Harbor Naval Shipyard (PHNSY), Norfolk Navy Shipyard (NNSY), Puget Sound Naval Shipyard (PSNSY), and Portsmouth Naval Shipyard, (PNSY)), the REPTECH Working Group, and Naval Undersea Warfare Center (NUWC) - Keyport. A secondary long-term objective is to identify other applications in which in-situ or field repair would result in cost savings, determine if a technology-based solution can help realize these savings, and then develop and transition the necessary technology

Payoff

ASW / MSW valve repairs require 3,390 man-hours per vessel and were identified by the Navy Executive Planning Sessions as being a “Top Priority Improvement Candidate”. Based on a 30% reduction in repair cost, the estimated cost avoidance for the Navy is $1.28M per year.

Implementation

This effort will develop a flexible repair tool for shipboard repair of ASW / MSW valves, comprised of a man-portable weld head manipulation tool and either a gas tungsten arc weld (GTAW) or a wire-based, deep-bore laser cladding head. The strategy is to define the problem in detail, develop conceptual flexible tools to address the problem, engineer suitable process heads and clamping systems, build a valve mock-up, and compare various cladding technologies. Pre-qualification data will be generated, and on-site demonstrations are planned to support transition. The system will leverage the laser recently procured by PHNSY for Vertical Launch System (VLS) Tube Repair. Technical contacts at NUWC – Keyport and the four shipyards are engaged in periodic reviews of technical documents and designs. NAVSEA 07T2 and 05M are also engaged. Supplemental funding to support design / fabrication of the man-portable manipulation tool has been awarded through the Defense Logistic Agency’s (DLA) Industrial Base Innovation Fund (IBIF) program. With this support, a technical specification for this tool (reviewed by all four shipyards) was sent out for competitive bid, and the subcontract has been awarded to AMET, Inc. The final tool was delivered in August 2011. A novel wire-based, laser-based, deep-bore cladding tool has been designed, fabricated, and refined, and has produced out-of-position clads on materials of interest. There is ongoing dialogue to commercialize this tool with various commercial suppliers. The tool is currently being used to produce qualification parts. Upon qualification, the tools will be demonstrated at PHNSY in mid-2012 and available to other shipyards.

Portable Cold Spray System to Address Several Different Repair Processes

A2366 — Portable Cold Spray Repair

Objective

There are several areas on DOD aircraft that do not currently have feasible repair methods. Repair methods are either non-existent or very complex and expensive. Examples include the F-18 airframe mounted accessory drive (AMAD) transmission housing cover, IVD aluminum and cladding repair of the aluminum structure, application of EMI/conductive coatings on the F-18, Alumiplate repair on the JSF, and dimensional repair on the H-60 tail cone canted bulkhead bushings and the AH-1 / UH-1N support case pad mounts, and well as others. An economical repair method that can easily be implemented is needed for a variety of repairs.

The objectives of this project are to develop and transition economical repair processes using a portable cold spray system for these and other components. The repair process will be demonstrated on subscale test articles and then qualified on the AMAD gear box housing and will include process and operating parameters, powder specifications, equipment specifications, and training. A decision tree will be developed in conjunction with NAVAIR 509 and used as a guide for applying the cold spray process to other components.

Payoff

The projected payoff of the technology developed in this project is based on the AMAD transmission housing repair with cost avoidance estimated at $500K per year. The transmission housings and covers have long manufacturing lead times. The ability to repair components will improve readiness and reduce life-cycle costs. Once this technology is successfully implemented for the AMAD transmission housing, the repair process can be implemented on additional applications / components to realize additional cost avoidance. Additional cost avoidance values will be included as they are identified. This process can also be used to repair and prevent corrosion damage.

Implementation

The technology will be transitioned to several NAVAIR facilities including the Fleet Readiness Centers (FRC)-E (Cherry Point) and -SW (North Island). NAVAIR has committed to implement the technology if successful. The technology will also be transitioned to the Materials Engineering Division: Corrosion & West Branch AIR-4.3.4.6 at Paxtuxent River. Additional applications will be developed and transitioned as well. NAVAIR will purchase equipment to implement the repairs, and Depot personnel will be trained to use the equipment and perform the repairs

PERIOD OF PERFORMANCE:
November 2010 to April 2013

PLATFORM:
REPTECH

AFFORDABILITY FOCUS AREA:
Coatings

CENTER OF EXCELLENCE:
iMAST

POINT OF CONTACT:
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STAKEHOLDER:
NAVAIR

TOTAL MANTECH INVESTMENT:
$500,000

Repairing Shaft Seals and Mating Rings Reduces Scrapping of Parts and the Required Purchase of Replacements

PERIOD OF PERFORMANCE:
January 2011 to March 2013

PLATFORM:
REPTECH

AFFORDABILITY FOCUS AREA:

CENTER OF EXCELLENCE:
iMAST

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Mr. Timothy D. Bair
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STAKEHOLDER:
PMS 450

TOTAL MANTECH INVESTMENT:
$274,000

S2418 — Refurbishment of SSN-688 Class Shaft Seal and Mating Rings

Objective

Shaft seal assemblies for LOS ANGELES (SSN-688) Class submarines are comprised of seal rings and mating rings. When assembled, these two components are installed at the interface between the hull and the main propulsion shaft. These components are removed during periodic maintenance availabilities and returned to the sole original equipment manufacturer for refurbishment. The refurbishment of these components typically involves the machining of selected surfaces to a highly polished finish and the removal of any damage or wear from the surface of the component. Once the entirety of the excess material is removed through multiple refurbishments, the part is then often scrapped, and a new component must be purchased as a replacement. This method of refurbishment limits the number of refurbishment cycles for each component.

The project objective is to evaluate and implement a mature additive repair process to improve the repair survivability of SSN-688 shaft seal and mating rings. This multi-phase project is being conducted in which the Institute for Manufacturing and Sustainment Technologies (iMAST) will develop processing parameters and procedures for the deposition of Inconel® 625 on shaft seal ring and mating ring components.

Payoff

The primary payoff is cost avoidance by repairing shaft seal and mating rings that would otherwise be scrapped. New component prices range from $140K to $200K. Current repair of shaft seal and mating rings ranges from 40% to 70%, of costs and 27K to $52K per unit for each refurbishment. Adding material via a laser deposition process will increase the repair survivability to near 100%, significantly reducing the number of new spare components that must be purchased. In addition to these direct cost savings, there will be a reduced lead time for parts at the depot.

Implementation

Three potential laser deposition processes are being evaluated including a LENS®-based deposition process, a powder-fed laser cladding process, and a wire-fed laser cladding process. After evaluation, one process will be down-selected for implementation at Navy Undersea Warfare Center (NUWC) - Keyport. The accompanying processing parameters and procedures will then be transferred to Keyport, where the repair of these components will be implemented.

In the first phase, iMAST and stakeholders will initiate a systematic process development effort to test the performance and applicability of three different laser deposition techniques for the laser deposition of Inconel® 625. In the second phase, iMAST will work with NUWC-Keyport to transfer the process and replicate the process parameters at NUWC-Keyport. After validation, NUWC-Keyport will begin a product testing cycle during which the required fixturing, inspection, pre- and post-machining, and processing procedures will be developed. After completion, NUWC-Keyport will produce qualification samples as per the qualification plan and a report will be prepared by both iMAST and NUWC-Keyport and submitted to NAVSEA for approval. Once NAVSEA approval is received, the project will be considered complete.

Improved Submarine Interior Finish Coatings (IFC) Reduce Total Ownership Cost

S2421-A — Advance Coatings

PERIOD OF PERFORMANCE:

April 2011 to January 2013 (iMAST)
June 2011 to June 2013 (CNST)

PLATFORM:

REPTECH

AFFORDABILITY FOCUS AREA:

Coatings

CENTER OF EXCELLENCE:

iMAST and CNST

POINT OF CONTACT:

Mr. Timothy D. Bair
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tdb14@psu.edu

STAKEHOLDER:

PMS 450
PMS 500

TOTAL MANTECH INVESTMENT:

$520,000 (iMAST)
$141,000 (CNST)

Objective

The appearance of interior and exterior painted surfaces of naval vessels is important to the Navy. A substantial amount of money is spent on reapplying finish coatings solely for cosmetic reasons. The cost associated with routine application of finish coatings to repair cosmetic damage goes well beyond the material and labor cost associated with application of the paint. Eliminating or reducing over-coating for cosmetic reasons will reduce both acquisition and total ownership costs (TOC). This project will investigate the suitability of newer, commercially-available coatings that can be used in interior spaces of submarines and surface ships and that will reduce coating repairs associated with cosmetic damage. The project will leverage work performed in the development of the Extended Durability Nonskid and Rapid-Cure Interior Deck (S2297) coatings projects. Coating formulation and design methodologies developed in those projects resulted in high-durability coatings exhibiting high toughness and cleanability. This project will further extend those efforts to interior finish coatings (IFC) with the emphasis on improving toughness, abrasion resistance, and cleanability.

The primary objective of this project is to develop an improved, high-durability interior finish coating having the following characteristics: (1) low or no volatile organic compounds (VOC), (2) improved cleanability, durability, scratch resistance, and stain resistance, (3) tint-able to match old coatings, (4) ability to feather-in with old / existing coatings, and (5) ability to cure in low temperatures and/or high humidity conditions.
An initial industry survey will evaluate acrylic and silicon-based polymer coatings. In parallel will be work to develop and evaluate a urethane-epoxy-silicon polymeric blend. Once one or more candidate coatings have been identified, project focus will be on demonstration and qualification.

Payoff

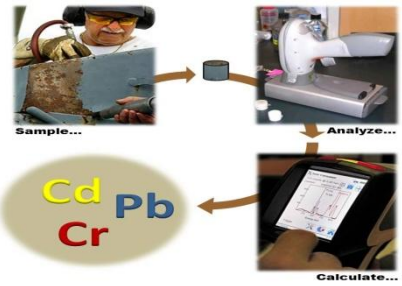
This project has ramifications to both new acquisition and total ownership cost (TOC) reduction. Acquisition savings accrue from reduced paint repair following sea-trials prior to final delivery of the Navy ship. TOC reductions are substantial and will accrue from the reduced need to paint as a result of improved cleanability and the ability to perform more spot-repairs as a result of improved color matching.

Implementation

To ensure transition, the project team includes end-user personnel, subject-matter experts, and coating management representatives. Additional funding following project completion will be needed to achieve full implementation and will depend on the success of the pilot paint program and business case analysis. To maximize implementation efficiency, one or more commercial coating suppliers will be approached and invited to participate with the ManTech project team to produce and sell the improved interior finish coating. Implementation is targeted for second quarter year 2013.

Note: This project is led by the Institute for Manufacturing and Sustainment Technologies (iMAST) with a portion of the work performed by the Center for Naval Shipbuilding Technology (CNST).

On-site Paint Analysis to Reduce Ship Repair Scheduling Delays



PERIOD OF PERFORMANCE:
February 2011 to December 2011

PLATFORM:
REPTECH

AFFORDABILITY FOCUS AREA:

CENTER OF EXCELLENCE:
iMAST

POINT OF CONTACT:
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tdb14@psu.edu

STAKEHOLDER:
SEA 04X
Shipyards

TOTAL MANTECH INVESTMENT:
$90,000

S2444 — XRF Analysis of Heavy Metals in Paint

Objective

Testing of paint on internal and external ship surfaces is required prior to other repair activities to identify levels of specific hazardous metals, such as lead (Pb), chromium (Cr), and cadmium (Cd). The data is used to ascertain applicability of Occupational, Safety and Health Administration (OSHA) regulations to production activities scheduled for each specific area of the ship. Testing of up to 500 samples per carrier and 200 samples per submarine may be required. Turnaround time for laboratory testing, data review, and approval can take up to two weeks with retests requiring additional time. Productions schedules and worker safety are dependent on these results.

Portable X-Ray Fluorescence (XRF) analyzers are commercially available that are capable of measuring Pb, Cr, and Cd in powdered paint at levels below 50 ppm. These analyzers can be used on-site (ship-side) and will provide results within two minutes after on-site sample preparation.

The objective of this project is to evaluate and validate a portable commercial-of-the-shelf (COTS) X-ray Fluorescence (XRF) analyzer for the ship-side analysis of lead, chromium, and cadmium in paint with the end results being (1) reduction in ship repair scheduling delays, (2) minimized sample turnaround times, and (3) streamlined sample tracking and custody issues.

Payoff

Implementation of portable XRF analyzers will allow for on-site analysis of paint samples during both “pre-availability” and “availability” time-frames. On-site analysis will enable access to the heavy metal results immediately after sampling and testing, thereby reducing or eliminating current scheduling delays for the initiation of repair and production activities due to waiting for laboratory test results. Preliminary data indicates that the cost for laboratory testing is $140/sample, while the cost using a portable XRF Analyzer is targeted to be $10/sample for a significant reduction.

Implementation

In order for ship-side heavy metals analysis to be successfully implemented in the shipyards, each shipyard will have to conduct additional shipyard method validation, obtain necessary shipyard and OSHA approvals, define modified shipyard work processes and flows, conduct training of personnel on the new analysis procedure, and purchase at least one XRF analyzer.

Data and findings from this project will directly aid in the transition and implementation in the shipyards. Throughout the project, radiation safety issues are being discussed and addressed; a demonstration including input from shipyard personnel will be conducted at Norfolk Naval Shipyard; sample preparation, analytical validation, and data comparing portable XRF results to laboratory results on the same samples will be collected; and a list of suitable vendors, XRF models and specification will be provided.

Engineering, production, Occupational Safety and Health and Environment (OSHE), radiation safety, and laboratory personnel from all four naval shipyards have been involved throughout this project to facilitate transition to and implementation in the shipyards as early as 2012.

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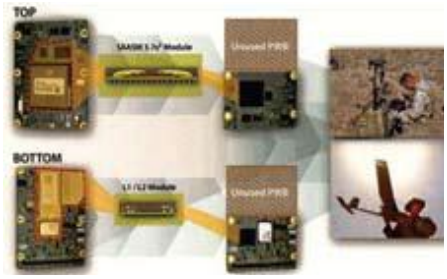
Note: The projects included in this section are projects funded not out of the Navy ManTech line but out of the Manufacturing Science and Technology (MS&T) Program (the DOD ManTech line).

The Defense-wide Manufacturing Science and Technology (MS&T) Program was mandated by Congress in Section 241 of the National Defense Authorization Act of 2006, under the authority of Section 2521 of Title 10, to identify and transition advanced manufacturing processes and technologies that would achieve significant productivity and efficiency gains within the defense industrial base. The program complements the Service and Agency Manufacturing Technology programs by focusing on multi-service DOD priorities which are identified and ranked through roadmapping and data call activities conducted in collaboration with DOD and industry manufacturing representatives.

DOD ManTech Projects

Advanced Packaging Technologies Enable Smaller, Lighter, Lower Power, and More Rugged GB-GRAM Units



PERIOD OF PERFORMANCE:
May 2008 to May 2011

PLATFORM:
DOD ManTech

AFFORDABILITY FOCUS AREA:
Electronics Processing and Fabrication

CENTER OF EXCELLENCE:
EMPF

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STAKEHOLDER:
U.S. Army Global Positioning Systems

TOTAL INVESTMENT:
$3,255,000

J2251 — Advanced Packaging Technology with Insertion into Defense Systems (APTIDS)

Objective

The Advanced Packaging Technology with Insertion into Defense Systems (APTIDS) project produced miniaturized Ground Based Global Positioning System Receiver Application Modules (GB-GRAM) units for implementation in military systems. This module demonstrated the application of advanced packaging technologies and techniques in both Radio Frequency (RF) and high speed digital modules to provide SWaP-C (size, weight, power, and cooling) solutions for DOD applications. Knowledge and practices gained through the APTIDS project was provided to the DOD industry, thereby multiplying the benefits of a single project. Advanced packaging technology from the commercial sector was leveraged to provide solutions to military electronics problems.

Payoff

The expected benefits will be focused on significant reductions in board space. A reduction in space will enable the customer to either reduce the size of the board or add additional capability to it, while staying within its current dimensional constraints. This effort resulted in an RF module volume reduction of 97% and a GPS receiver engine volume reduction of nearly 75% over their previous designs. Assembling both modules into a Next Generation GB-GRAM will produce a module that is 30% of its current volume. The project demonstrated that the prototype unit met all operation specifications of the larger GB-GRAM module currently under development by the Army.

The main benefits of this project were size reductions of the GB-GRAM, RF, and Global Positioning System (GPS) modules by approximately 70%, 97%, and 76% respectively. The small, modular design enabled the rapid development and deployment of GPS in a variety of systems. Component standardization made it possible for high volume GPS components to be used across DOD communications and weapons platforms. Decreases in cost of such systems, accompanied by significant increases in the technical readiness and manufacturing readiness levels, occurred as a result of this project. Improved anti-jam features were also incorporated into these devices

Implementation

The manufacturing processes developed under this project led to the design and development of the MicroGRAM GPS receiver by Rockwell Collins that can be incorporated into a wide variety of military systems. This GPS receiver is 90 percent smaller than the earlier version of the Miniature Precision Lightweight GPS Receiver Engine SAASM (MPE™-S). The extraordinary size reduction means that equipment such as handheld radios, ruggedized field computers, laser range finders, gun scopes, and small unmanned aircraft can now be equipped with military GPS capability having unique security features.

The technologies developed as a result of this work have wide ranging applicability to military programs. Under this project, small form-factor Global Positioning Receiver and Radio Frequency modules were developed. These elements were combined to produce a prototype GB-GRAM module which was tested to Army GPS specifications and compared to a module fabricated using standard manufacturing technology.

Improved Manufacturing of Prosthetics Results in Reduced Cost, Increased Performance, Restoration of the Warrior's Quality of Life

J2256 — Prosthetics and Orthotics Manufacturing Initiative (POMI) Phase 1

Objective

In the current engagement, more Warriors are surviving injuries and living with amputations. The capabilities of our military care system are strained by the increased numbers of amputations, and by the functional demands to which our young Warriors wish to be restored. While the current care systems are providing excellent care, new opportunities are available to improve the processing and manufacturing of prosthetic systems to increase durability and comfort and to provide medical personnel the tools to care for our most deserving heroes. The objective of this project is to dramatically improve the quality and comfort of sockets for lower-extremity prosthetic systems by shifting away from the current experience-based design and production paradigm. This project will leverage the Prosthetics & Orthotics Manufacturing Initiative (POMI) Phase Zero effort allowing intelligent design decisions, informed by both load requirements and soft tissue reactions. With the design in hand, the socket will be produced using an advanced technique developed for the aerospace and defense industries, namely, braiding. This will allow for a socket with spatially-variable properties to be produced with a high degree of automation and with superior quality, and will also produce sockets strong enough to withstand extreme uses, such as may be experienced by warriors returning to combat. The project will implement resins developed in other areas into the field of prosthetics to enable local modifications of the composite structure that might be required during the fit process and during use as the residual limb either changes volume or experiences heterotopic ossification (abnormal bone growth

Payoff

The project's end result will enable prosthetists at military and commercial hospitals to produce lighter, more comfortable, and more intelligently designed sockets in less time, using automated processes, thus freeing them to spend more time on patient care and less time with socket production. Sockets will have longer service lives with reduced production and lifecycle costs and will restore the warrior's quality of life.

Implementation

Automated braiding was successfully developed and provides approximately 40% savings over traditional fabrication methods. An industry partner has signed agreements to serve as a distributor for the braiders to all customers. Two central fabrication facilities, which supply components directly to the government and commercial markets, have purchased braiders. Further purchases are anticipated from academic institutions interested in training future medical personnel. In addition, a new sensor system for measuring the pressure exerted on the residual limb by the socket has been commercially launched. This system has been initially adopted by both clinical and research users.

PERIOD OF PERFORMANCE:
August 2008 to March 2012

PLATFORM:
DOD ManTech

AFFORDABILITY FOCUS AREA:
Composites Processing and Fabrication

CENTER OF EXCELLENCE:
CMTC

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STAKEHOLDER:
Walter Reed Army Medical Center

TOTAL MANTECH INVESTMENT:
$2,799,000

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